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WALSH'S NEW  
GRAMMAR SCHOOL  
ARITHMETIC

PART  
ONE

D·C·HEATH & CO. BOSTON

Ex. T 119.04.910

I



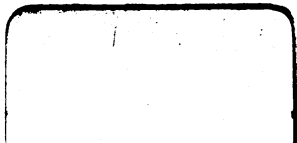
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Example 40. p 57 taken from Nicolas  
Péris' *Arithmétique* pub. 1795

" 18 p 55 } Problems like these  
" 5 p 184 } are absurd and  
" 14 p. 107 } useless. The book  
9 + 2 p. 211 } is full of them.  
83 p. 111 }

See examples on p 152 Section 233.

See p 103 last 2 lines. - why is this so?

Examples Pages

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**NEW**

**GRAMMAR SCHOOL ARITHMETIC**

**PART I**

**BY**

**JOHN H. WALSH**

**ASSOCIATE SUPERINTENDENT OF SCHOOLS, THE CITY  
OF NEW YORK**

**BOSTON, U.S.A.**

**D. C. HEATH & CO., PUBLISHERS**

**1904**

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## INTRODUCTION.

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THE New Grammar School Arithmetic forms with the New Primary Arithmetic a complete course in elementary school mathematics.

Each of the first four chapters of the New Grammar School Arithmetic provides for a half year, beginning with advanced matter, which is followed by a review and an extension of the topics of the preceding grades. Each of the next two chapters (V and VI) contains arithmetic work for a year, which should be supplemented by portions of the algebraic and geometrical material of Chapters VII and VIII. It is recommended that at least a portion of the work in equations of Chapter VII should precede the study of Chapter V.

Among the special features of the New Grammar School Arithmetic are the number and the variety of the problems; the systematic reviews, which cover oral and written drill work even in the fundamental operations; the attention paid to short, direct, business methods of computation; and the spiral handling of the various topics.



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## SUGGESTIONS TO TEACHERS.

**Additions and Omissions.** — The teacher should freely supplement the work of the text-book when she finds it necessary to do so ; and she should not hesitate to leave a topic that her pupils fully understand, even though they may not have worked all the examples given in connection therewith.

**Oral and Written Work.** — The heading "Written Problems" is merely a general direction, and it should be disregarded by the teacher when the pupils are able to do the work "mentally." The use of the pencil should be required only so far as it may be necessary. It is a pedagogical mistake to insist that the brighter pupils of a class should set down a number of figures that they do not need. As an occasional exercise, the pupils may be directed to give all the work required to solve a problem, and to make a written explanation of each step in the solution ; but it should be the teacher's aim to have the majority of the examples done with as great rapidity as is consistent with absolute correctness. It will be found that, as a rule, the quickest workers are the most accurate.

**Conduct of the Recitation.** — It is often advisable, for some purposes, to divide an arithmetic class into two sections, even where the pupils are nearly equal in attainments. The members of one section may work examples from their books while the others write the answers to oral problems given by the teacher, etc.

Where a class is thus taught in two divisions, the members of each should sit in alternate rows, extending from the front of the room to the rear. Seated in this way each pupil is doing a different kind of work from those on the right and the left, and he does not have the temptation of a neighbor's work to lead him to compare answers.

To save time, explanations of new subjects may be given to the whole class ; but much of the arithmetic work should be done in "sections," one of which is under the immediate direction of the teacher, while the other is employed in "seat" work. The "seat" work of pupils of the more advanced classes should consist largely of problems solved without assistance. Especial pains have been taken to grade the



problems so as to have none beyond the capacity of the average pupil. It is not necessary that all the members of a division should work the same problems at a given time, or the same number of problems, or that a new topic should be postponed until all of the previous problems have been solved.

Whenever it is possible, each of the members of the division working under the teacher's immediate direction should take part in all the work done. In mental arithmetic, for instance, while only a few may be called upon for explanations, all of the pupils should write the answers to each question. The same is true of much of the sight work, the approximations, some of the special drills, etc.

**Drills and Sight Work.**—To secure reasonable rapidity, it is necessary to have regular and systematic drills. These should be employed frequently, but should not last longer than five or ten minutes. A page of special sight drills is given in each chapter. These may also be used in oral problems.

It often happens that as pupils go forward in school they lose much of the readiness in oral and written work that they possessed in the lower grades, owing to the neglect of their teachers to continue to require quick, accurate review work in the operations previously taught. In this book these special drills follow the plan of the combinations of the earlier book, but gradually grow more difficult. They should first be used as sight exercises, either from the books or from the blackboard.

To secure valuable results from drill exercises, the utmost promptness in answers should be required.

**Language.**—While the use of correct language should be insisted upon in all lessons, children should not be required in arithmetic to give all answers in "complete sentences." Especially in the drills, it is important that the results be expressed in the fewest possible words. The teacher should be careful always to employ exact arithmetical language and to require it from the pupils.

**Objective Illustrations.**—The chief reason for the use of objects in the study of arithmetic is to enable pupils to work without them. While counters, weights and measures, diagrams, or the like are necessary at the beginning of some topics, it is important to discontinue their use as soon as the pupil is able to proceed without their aid.

**Approximate Answers.**—An important drill is furnished in the "approximations" (see Arts. 104, 180, 233, etc.). Pupils should be required in much of their written work to estimate the result before beginning to solve a problem with the pencil. Besides preventing an

absurd answer, this practice will also have the effect of causing a pupil to see what processes are necessary. In too many instances, work upon a problem is commenced before the conditions are grasped; this will be less likely to occur in the case of one who has carefully "estimated" the answer. The pupil will frequently find, also, that he can obtain the correct result without using his pencil.

**Indicating Operations.** — It is a good practice to require pupils to indicate by signs all of the processes necessary to the solution of a problem, before performing any of the operations. This frequently enables a pupil to shorten his work by cancellation, etc. In the case of problems whose solution requires tedious processes, some teachers do not require their pupils to do more than to indicate the operations. It is to be feared that much of the lack of facility in adding, multiplying, etc., found in the pupils of the higher classes is due to this desire to make work pleasant.

**Sight Exercises.** — Many pupils who find it difficult to solve problems read to them readily make the necessary calculations without a pencil when they have the numbers before them on the blackboard, or in their books. It may be found advisable to have a class first solve the whole of a given set of oral problems from their books, and at a later lesson write the answer to each question after it has been read by the teacher. In the case of sight exercises too difficult to be solved mentally, the set might be taken up one at a time by individual pupils, after which the pupils might be required to write answers "at sight" at a signal from the teacher. If the exercises are on the blackboard, the teacher might use a pointer to indicate the example whose answer was desired, not following the order in which they appeared on the blackboard. A similar method might be employed in sight work done from the books.



# NEW GRAMMAR SCHOOL ARITHMETIC.



## CHAPTER I.

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Approximate Answers, Review Problems.	

### MIXED NUMBERS.

#### 1. Preliminary Exercises.

How many halves in 1?    How many fourths in 1?    Six halves = ?    12 fourths = ?    6 thirds = ?    12 sixths = ?

$$\frac{2}{2} = ? \quad \frac{3}{2} = ? \quad \frac{5}{2} = ? \quad \frac{7}{2} = ? \quad 1\frac{1}{2} = ? \quad 1\frac{3}{2} = ?$$

2. A *mixed number* is a whole number and a fraction written together.

3. A *proper fraction* is a fraction whose numerator is less than its denominator.

An *improper fraction* is a fraction whose numerator is equal to or greater than its denominator.

4. Change each of the following improper fractions to a whole number or to a mixed number:

$$\frac{12}{8}$$

$$\frac{15}{4}$$

$$\frac{17}{2}$$

$$\frac{18}{6}$$

$$\frac{23}{4}$$

$$\frac{21}{8}$$

$$\frac{5}{6}$$

### 5. Oral Exercises.

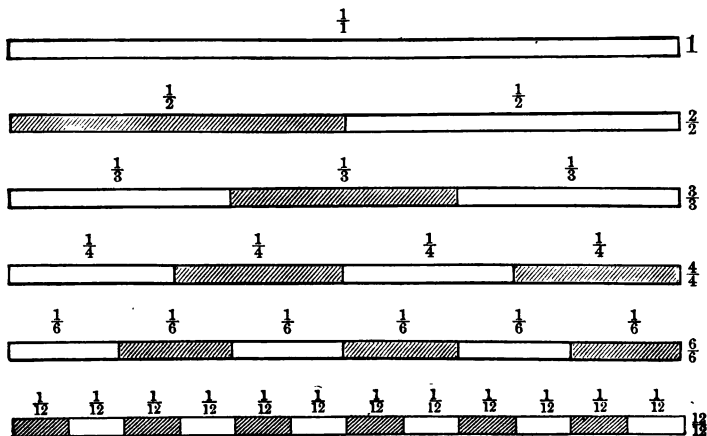
How many quarts in a gallon?

What part of a gallon is a quart?

$\frac{1}{2}$  gallon = how many quarts?  $\frac{1}{2}$  = how many fourths?

How many quarts in a peck? What part of a peck is one quart? One-half peck is how many quarts? One-half = how many eighths?

$\frac{1}{4}$  peck is how many quarts?  $\frac{1}{4}$  = how many eighths?  $\frac{2}{4}$  = how many eighths?  $\frac{3}{4}$  = how many eighths?



6. Draw a line one foot long. Draw a second line of the same length; divide it into halves. Divide a third line of the same length into three equal parts. Divide three other lines, one into fourths, one into sixths, and one into twelfths.

How many inches in a foot? What part of a foot is one inch?  $\frac{1}{2}$  foot = how many inches?  $\frac{1}{2}$  = how many twelfths?

$\frac{1}{3}$  = how many twelfths?  $\frac{2}{3}$  = how many twelfths? Change  $\frac{1}{4}$  to twelfths. Change  $\frac{2}{4}$ ,  $\frac{3}{4}$  to twelfths. How many twelfths =  $\frac{1}{6}$ ?  $\frac{2}{6}$ ?  $\frac{3}{6}$ ?  $\frac{4}{6}$ ?  $\frac{5}{6}$ ?  $\frac{6}{6}$ ?

$$\frac{2}{12} = \frac{1}{6}$$

$$\frac{3}{12} = \frac{1}{4}$$

$$\frac{4}{12} = \frac{1}{3} = \frac{2}{6}$$

$$\frac{6}{12} = \frac{1}{2} = \frac{2}{4} = \frac{3}{6}$$

$$\frac{8}{12} = \frac{2}{3} = \frac{4}{6}$$

$$\frac{9}{12} = \frac{3}{4}$$

$$\frac{10}{12} = \frac{5}{6}$$

$$\frac{11}{12} = \frac{11}{12} = \frac{5}{6} = \frac{10}{12}$$

How many inches in  $\frac{1}{2}$  ft. +  $\frac{1}{3}$  ft. +  $\frac{1}{4}$  ft. +  $\frac{1}{6}$  ft. +  $\frac{1}{12}$  ft.? How many feet and inches?

How many 12ths in  $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{6} + \frac{1}{12}$ ? Change to a mixed number. Change the fractional part to a different fraction having the same value.

What fraction of a dime is 1 cent?  $\frac{1}{2}$  dime = how many cents?  $\frac{1}{2} = \frac{5}{10}$ .

$\frac{1}{3}$  dime = how many cents?  $\frac{1}{3} = \frac{3}{9}$ . Change  $\frac{2}{3}$  to tenths.  $\frac{2}{3}$ .  $\frac{4}{6}$ .  $\frac{8}{12}$ .

Add  $\frac{1}{2}$  dime,  $\frac{1}{3}$  dime, and  $\frac{1}{10}$  dime. How many cents? How many tenths =  $\frac{1}{2} + \frac{1}{3} + \frac{1}{10}$ ? Can you change the answer to a different fraction having the same value?

## 7. Oral Problems.

1. I spent  $\frac{1}{2}$  of a dollar for a ball and  $\frac{1}{10}$  of a dollar for a bat. What part of a dollar did I spend for both?

2. What is the cost of a pen-knife at  $\frac{2}{3}$  of a dollar, and a book at  $\frac{1}{4}$  of a dollar?

3. I need  $\frac{1}{3}$  of a yard of ribbon for one hat and  $\frac{1}{6}$  of a yard for another. How much ribbon should I buy?

4. Sold  $\frac{3}{8}$  of a pound of tea to one customer and  $\frac{7}{8}$  to another. How much was sold to both?
5. What quantity of oats should I buy to give  $\frac{3}{4}$  of a peck to one horse and  $\frac{5}{8}$  to another?
6. If I sell  $\frac{1}{3}$  of a dozen of oranges to one person and  $\frac{1}{4}$  of a dozen to another person, what part of a dozen do I sell?
7.  $\frac{3}{5}$  of an hour is how many minutes?
8. I spent  $\frac{1}{3}$  of an hour reading and  $\frac{2}{10}$  of an hour writing. What part of an hour did I spend at both?
9. A boy is carrying  $6\frac{1}{4}$  pounds of flour, and  $6\frac{1}{4}$  pounds of ham. What is the weight of his load?
10. 18 hours are what part of a day?

#### ADDITION OF MIXED NUMBERS.

8. In fractions the numbers above the line are called *numerators*; the numbers below the line are called *denominators*.

The numerator and the denominator are called the *terms* of a fraction.

To add fractions they must have a common denominator.

A *common denominator* is a number that will exactly contain all the denominators.

The *least common denominator* is the least number that will exactly contain all the denominators.

9. Add  $12\frac{1}{2}$ ,  $6\frac{2}{3}$ ,  $8\frac{1}{4}$ ,  $15\frac{5}{6}$ ,  $\frac{3}{8}$ .

$$\begin{array}{r}
 24 \\
 12\frac{1}{2} \quad 12 \\
 6\frac{2}{3} \quad 16 \\
 8\frac{1}{4} \quad 6 \\
 15\frac{5}{6} \quad 20 \\
 \frac{3}{8} \quad 9 \\
 \hline
 43\frac{3}{4} \quad 44
 \end{array}
 = 21\frac{5}{4} = 25. \quad \text{Ans. } 43\frac{3}{4}.$$

## Mixed Numbers.

5

An inspection of the denominators, 2, 3, 4, 6, 8, shows that **24** is the smallest number that will contain each without remainder. This is the *least common denominator*.

Instead of writing the least common denominator 24, with each fraction, we may place it above, and write only the new numerators.  $\frac{1}{2} = \frac{12}{24}$ ,  $\frac{2}{3} = \frac{16}{24}$ ,  $\frac{1}{4} = \frac{6}{24}$ , etc. Write 12, 16, 6, 20, 9. The sum of these numerators, 63, is written over the denominator 24, making the sum of the fraction  $\frac{63}{24}$ . This improper fraction is reduced to  $2\frac{1}{2}$ , and the fractional part is reduced to  $\frac{1}{2}$ .  $\frac{1}{2}$  is placed under the fractions to be added, and 2 is carried to the whole numbers, making 43.

*Add the fractions and unite their sum with the sum of the integers.*

The fractional parts of answers should be reduced to *lowest terms*.

### 10. Written Exercises.

Add:

- |                     |                     |                      |                      |                      |
|---------------------|---------------------|----------------------|----------------------|----------------------|
| 1. $23\frac{1}{2}$  | 2. $73\frac{1}{4}$  | 3. $93\frac{2}{3}$   | 4. $11\frac{2}{3}$   | 5. $18\frac{1}{2}$   |
| $63\frac{1}{2}$     | $8\frac{1}{4}$      | $2\frac{1}{3}$       | $3\frac{1}{2}$       | $7\frac{2}{3}$       |
| $7\frac{2}{3}$      | $39\frac{2}{10}$    | $74\frac{5}{12}$     | $20\frac{2}{14}$     | $9\frac{2}{10}$      |
| $3\frac{2}{10}$     | $16\frac{1}{2}$     | $6\frac{1}{3}$       | $5\frac{1}{2}$       | $\frac{1}{2}$        |
| 6. $12\frac{1}{2}$  | 7. $19\frac{1}{4}$  | 8. $73\frac{2}{3}$   | 9. $51\frac{1}{2}$   | 10. $100\frac{1}{2}$ |
| $3\frac{5}{10}$     | $7\frac{2}{3}$      | $98\frac{1}{3}$      | $38\frac{1}{4}$      | $75\frac{2}{3}$      |
| $27\frac{2}{4}$     | $34\frac{2}{3}$     | $\frac{1}{3}$        | $23\frac{2}{3}$      | $9\frac{1}{4}$       |
| $8\frac{1}{2}$      | $\frac{1}{2}$       | $33\frac{1}{2}$      | $17\frac{1}{3}$      | $49\frac{1}{4}$      |
| 11. $33\frac{1}{2}$ | 12. $6\frac{1}{10}$ | 13. $103\frac{1}{3}$ | 14. $218\frac{2}{3}$ | 15. $444\frac{2}{3}$ |
| $17\frac{2}{3}$     | $18\frac{2}{3}$     | $84\frac{2}{3}$      | $301\frac{2}{3}$     | $518\frac{2}{3}$     |
| $24\frac{5}{12}$    | $32\frac{1}{4}$     | $25\frac{1}{2}$      | $18\frac{1}{2}$      | $37\frac{1}{2}$      |
| $69\frac{1}{4}$     | $94\frac{1}{4}$     | $9\frac{2}{3}$       | $24\frac{2}{3}$      | $95\frac{2}{3}$      |



## 11. Written Problems.

1. A merchant sold  $17\frac{3}{4}$  yards of muslin,  $14\frac{1}{2}$  yards of silk, and as many yards of calico as of the other two together. How many yards did he sell in all?

2. A boy has to walk from his home to a house  $1\frac{3}{4}$  miles east of his home, and from there to a place  $2\frac{1}{2}$  miles west of his home. How far has he to walk?

3. From a piece of cloth  $17\frac{1}{2}$  yards,  $5\frac{3}{4}$  yards, and  $4\frac{3}{4}$  yards were sold. How many yards were sold?

4. A man walked  $12\frac{5}{16}$  miles Tuesday,  $16\frac{3}{8}$  miles Wednesday,  $22\frac{7}{10}$  miles Thursday. How far did he walk in 3 days?

5. A farmer owned 3 fields containing, the first  $21\frac{3}{4}$  acres, the second  $27\frac{3}{8}$  acres, and the third  $28\frac{9}{10}$  acres. How many acres were there in all?

6. A man bought 3 loads of wood containing respectively  $1\frac{1}{4}$  cords,  $1\frac{3}{8}$  cords, and  $1\frac{5}{8}$  cords. How many cords of wood did he buy?

7. A man has  $10\frac{1}{2}$  acres of wheat,  $6\frac{3}{8}$  acres of corn,  $20\frac{5}{8}$  acres of barley,  $16\frac{3}{8}$  acres of rye. How many acres of grain has he?

8. William lives  $24\frac{1}{2}$  rods from school, James  $6\frac{3}{10}$  rods farther than William, and Charles  $10\frac{1}{2}$  rods farther than James. How far does Charles live from school?

9. Henry weighs  $58\frac{3}{8}$  pounds, Peter  $65\frac{1}{4}$  pounds, and John  $67\frac{7}{8}$  pounds, and their father as much as all three of them. How much does their father weigh?

10. A dealer mixed  $2\frac{1}{2}$  pounds of black tea costing 32 cents per pound with  $1\frac{1}{2}$  pounds of green tea costing 40 cents per pound. How much per pound does the mixed tea cost him?

## SUBTRACTION OF MIXED NUMBERS.

## 12. Preliminary Exercises.

$$1 - \frac{1}{2} = ? \quad 1\frac{1}{4} - \frac{1}{2} = ? \quad 10 - \frac{1}{2} = ? \quad 10\frac{1}{4} - \frac{1}{2} = ? \quad 10\frac{1}{4} - 1\frac{1}{2} = ?$$

In subtraction of mixed numbers, as in addition, the fractions must have a common denominator.

Subtract:

- |                                                                              |                                                                              |                                                                            |                                                                              |                                                                              |
|------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 1. $\begin{array}{r} 16\frac{1}{2} \\ 13\frac{7}{2} \\ \hline \end{array}$   | 2. $\begin{array}{r} 49\frac{1}{10} \\ 37\frac{2}{10} \\ \hline \end{array}$ | 3. $\begin{array}{r} 38\frac{2}{4} \\ 29\frac{1}{4} \\ \hline \end{array}$ | 4. $\begin{array}{r} 18\frac{3}{16} \\ 14\frac{5}{16} \\ \hline \end{array}$ | 5. $\begin{array}{r} 27\frac{9}{10} \\ 16\frac{1}{10} \\ \hline \end{array}$ |
| 6. $\begin{array}{r} 28\frac{7}{16} \\ 13\frac{5}{16} \\ \hline \end{array}$ | 7. $\begin{array}{r} 47\frac{7}{8} \\ 29\frac{5}{8} \\ \hline \end{array}$   | 8. $\begin{array}{r} 36\frac{1}{4} \\ 18\frac{5}{4} \\ \hline \end{array}$ | 9. $\begin{array}{r} 25\frac{1}{8} \\ 19\frac{1}{8} \\ \hline \end{array}$   | 10. $\begin{array}{r} 32\frac{1}{8} \\ 18\frac{7}{8} \\ \hline \end{array}$  |

13. From  $197\frac{2}{3}$  take  $68\frac{2}{3}$ .

	15	
$197\frac{2}{3}$	9	Reduce the fractions to the least common denominator
$68\frac{2}{3}$	10	15, as in addition of fractions. $\frac{1}{3}$ being greater than
$128\frac{1}{3}$	$\frac{1}{3}$	$\frac{2}{3}$ , we change $197\frac{2}{3}$ to $196 + 1\frac{2}{3}$ , or $196\frac{1}{3}$ . $\frac{1}{3} - \frac{1}{3}$
		$= \frac{0}{3}$ . $196 - 68 = 128$ . Ans. $128\frac{1}{3}$ .

*Reduce the fractions to the least common denominator, and subtract the fractions and the integers separately.*

## 14. Written Exercises.

- |                                                                               |                                                                             |                                                                             |                                                                                |                                                                               |
|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 1. $\begin{array}{r} 35\frac{1}{2} \\ -8\frac{2}{2} \\ \hline \end{array}$    | 2. $\begin{array}{r} 63\frac{1}{2} \\ -9\frac{1}{4} \\ \hline \end{array}$  | 3. $\begin{array}{r} 27\frac{2}{3} \\ -17\frac{1}{3} \\ \hline \end{array}$ | 4. $\begin{array}{r} 55\frac{5}{8} \\ -25\frac{3}{8} \\ \hline \end{array}$    | 5. $\begin{array}{r} 105\frac{3}{10} \\ -8\frac{1}{10} \\ \hline \end{array}$ |
| 6. $\begin{array}{r} 120\frac{5}{8} \\ -84\frac{3}{8} \\ \hline \end{array}$  | 7. $\begin{array}{r} 39\frac{2}{3} \\ -38\frac{1}{4} \\ \hline \end{array}$ | 8. $\begin{array}{r} 13\frac{5}{8} \\ -7\frac{5}{12} \\ \hline \end{array}$ | 9. $\begin{array}{r} 99\frac{5}{8} \\ -21\frac{3}{8} \\ \hline \end{array}$    | 10. $\begin{array}{r} 67\frac{3}{4} \\ -59\frac{1}{4} \\ \hline \end{array}$  |
| 11. $\begin{array}{r} 100\frac{3}{10} \\ 76\frac{2}{5} \\ \hline \end{array}$ | 12. $\begin{array}{r} 25\frac{3}{10} \\ 5\frac{1}{2} \\ \hline \end{array}$ | 13. $\begin{array}{r} 93\frac{3}{8} \\ 24\frac{1}{8} \\ \hline \end{array}$ | 14. $\begin{array}{r} 101\frac{2}{11} \\ 98\frac{7}{11} \\ \hline \end{array}$ | 15. $\begin{array}{r} 12\frac{3}{4} \\ 4\frac{1}{4} \\ \hline \end{array}$    |

16. $23\frac{4}{5}$ <u><math>16\frac{7}{10}</math></u>	17. $9\frac{5}{8}$ <u><math>3\frac{1}{8}</math></u>	18. $133\frac{3}{4}$ <u><math>27\frac{7}{8}</math></u>	19. $16\frac{1}{11}$ <u><math>3\frac{8}{22}</math></u>	20. $37\frac{1}{2}$ <u><math>29\frac{1}{4}</math></u>
21. $52\frac{3}{5}$ <u><math>49\frac{4}{5}</math></u>	22. $64\frac{2}{3}$ <u><math>18\frac{1}{3}</math></u>	23. $125\frac{7}{10}$ <u><math>100\frac{2}{5}</math></u>	24. $47\frac{1}{3}$ <u><math>8\frac{2}{3}</math></u>	25. $72\frac{1}{10}$ <u><math>50\frac{1}{5}</math></u>
26. $31\frac{3}{8}$ <u><math>27\frac{5}{12}</math></u>	27. $63\frac{1}{3}$ <u><math>44\frac{1}{3}</math></u>	28. $3\frac{1}{2}$ <u><math>1\frac{1}{8}</math></u>	29. $25\frac{2}{3}$ <u><math>17\frac{1}{2}</math></u>	30. $102\frac{5}{12}$ <u><math>86\frac{1}{2}</math></u>

## 15. Oral Problems.

1. A man had  $\$6\frac{1}{2}$ , and he spent  $\$3\frac{1}{2}$ . How much money had he left?

2. Take  $\$8\frac{1}{4}$  from  $\$12\frac{3}{4}$ . How many quarters of a dollar are there in the remainder?

3. One-half of our books are in the case; we have in all 184 books; one-half of the remainder are on the table. How many are on the table?

4. If 6 apples cost 14 cents, what will 3 cost?

5. How many hours from 10 A.M. to 10 P.M.?

6. A man had 1000 acres of land and sold  $996\frac{1}{4}$  acres. How many acres had he left?

7. If a man earns  $\$14\frac{1}{2}$  in a week, and spends  $\$8\frac{3}{4}$ , how much does he save?

8. Bought sugar for  $5\frac{3}{4}$  cents a pound, and sold it for  $6\frac{1}{4}$  cents a pound. What was the gain on 200 pounds?

9. What will  $12\frac{3}{8}$  pounds of beef cost at 16 cents a pound?

10. If a girl studies  $5\frac{1}{4}$  hours in school, and  $1\frac{1}{4}$  hours at home each day, how many hours does she study in a week of five days?

## 16. Written Problems.

1. The weight of a tub of butter, including the weight of the tub, is  $48\frac{1}{4}$  pounds. The tub weighs  $9\frac{1}{2}$  lb. What is the butter worth at 24 cents per pound?

2. A farmer had 7 bushels of potatoes. He used 2 bushels and 3 pecks for seed. What would the remainder be worth at 20 cents per peck?

3. How much heavier is a cheese weighing  $40\frac{5}{8}$  pounds than one which weighs  $26\frac{3}{4}$  pounds?

4. A farmer having 217 bushels of corn sold  $95\frac{1}{2}$  bushels; how many bushels had he left?

5. A milliner gained  $1\frac{7}{8}$  dollars by selling a hat for  $6\frac{3}{4}$  dollars; what did it cost her?

6. From a cask of oil containing  $43\frac{3}{8}$  gallons,  $17\frac{3}{4}$  gallons were drawn; how many gallons remained?

7. A man having  $25\frac{7}{8}$  dollars paid  $6\frac{1}{2}$  dollars for coal,  $2\frac{1}{2}$  dollars for dry goods, and  $\frac{3}{4}$  of a dollar for a pound of tea; how much had he left?

8. A butcher buys an ox weighing alive 1200 pounds, at 6 cents per pound. When killed and dressed, its weight is  $\frac{2}{3}$  of the live weight. What is the butcher's profit, if he sells the meat at an average of 15 cents per pound?

9. A farmer sold  $36\frac{1}{2}$  dozen eggs to one storekeeper,  $5\frac{3}{4}$  dozen to another,  $17\frac{3}{4}$  dozen to a third,  $8\frac{5}{8}$  dozen to a fourth, and  $11\frac{7}{8}$  dozen to a fifth. How much did he receive for them at 12 cents per dozen?

10. A teacher's salary per month is  $135\frac{7}{10}$  dollars, and his expenses average  $51\frac{7}{8}$  dollars: how much does he save per month?

11. A man gave  $\frac{1}{3}$  of his money to his wife and  $\frac{1}{4}$  of it to his daughter. He divided the remainder equally among his three sons, each of whom received \$1000. How much money had he?

## MULTIPLICATION OF MIXED NUMBERS.

## 17. Preliminary Exercises.

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = ? \quad 3 \text{ times } \frac{1}{4} = ? \quad \frac{1}{4} \times 3 = ?$$

$$6 \text{ times } \frac{1}{4} = ? \quad 3 \text{ times } \frac{2}{5} = ? \quad \frac{2}{5} \times 3 = ?$$

$$\frac{2}{5} \times 9 = ? \quad \frac{3}{8} \times 15 = ? \quad \frac{3}{8} \times 17 = ?$$

$$\frac{3}{4} \times 7 = ? \quad \frac{5}{7} \times 20 = ? \quad \frac{4}{5} \times 12 = ?$$

$$\frac{5}{8} \times 5 = ? \quad \frac{3}{5} \times 13 = ? \quad \frac{5}{6} \times 10 = ?$$

## 18. Multiplication of a mixed number by an integer.

Find the product of  $235\frac{3}{4}$  by 39.

Multiply 3 by 39; divide the result by 4: the quotient,  $29\frac{1}{4}$ , is 39 times  $\frac{1}{4}$ . Write the next partial product,  $235 \times 9$ ; then the product of 135 by 3 tens. The sum of the three partial products gives the result, 9194 $\frac{1}{4}$ .

$$\begin{array}{r} 235\frac{3}{4} \\ 39 \\ 4 \overline{)117} \\ \underline{29\frac{1}{4}} \\ 2115 \\ 705 \\ \hline 9194\frac{1}{4} \text{ Ans.} \end{array}$$

## 19. Oral Exercises.

$$1. 1\frac{2}{5} \times 9 = ? \quad 3. 3\frac{5}{8} \times 5 = ? \quad 5. 5\frac{3}{8} \times 12 = ?$$

$$2. 2\frac{3}{4} \times 7 = ? \quad 4. 4\frac{2}{3} \times 8 = ? \quad 6. 6\frac{7}{8} \times 10 = ?$$

## 20. Written Exercises.

$$1. 215\frac{3}{8} \times 17 = ? \quad 3. 417\frac{3}{4} \times 20 = ? \quad 5. 619\frac{2}{10} \times 19 = ?$$

$$2. 316\frac{3}{8} \times 15 = ? \quad 4. 518\frac{7}{8} \times 13 = ? \quad 6. 720\frac{4}{11} \times 23 = ?$$

$$\begin{array}{r} 7. \quad 163\frac{3}{8} \\ \times 75 \\ \hline \end{array} \quad \begin{array}{r} 9. \quad 509\frac{1}{2} \\ \times 213 \\ \hline \end{array} \quad \begin{array}{r} 11. \quad 6089\frac{1}{2} \\ \times 1004 \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 103\frac{3}{4} \\ \times 17 \\ \hline \end{array} \quad \begin{array}{r} 10. \quad 308\frac{3}{4} \\ \times 156 \\ \hline \end{array} \quad \begin{array}{r} 12. \quad 1607\frac{3}{4} \\ \times 2340 \\ \hline \end{array}$$

**21. Multiplication of an integer by a mixed number.**Multiply 276 by  $280\frac{1}{8}$ .

Multiply 276 by the numerator, 3; divide the product by the denominator, 8; the quotient,  $103\frac{1}{4}$ , is the product of 276 by  $\frac{3}{8}$ . Multiply 276 by 8 tens and by 2 hundreds, etc.

$$\begin{array}{r}
 276 \\
 280\frac{1}{8} \\
 8 \overline{) 828} \\
 \underline{103\frac{1}{4}} \quad (1) \\
 2208 \\
 552 \\
 \hline
 77383\frac{1}{4} \text{ Ans.}
 \end{array}$$

*To multiply a whole number by a fraction, place the product of the numerator by the whole number over the denominator, and reduce, if possible.*

**22. Written Exercises.**

- |                                                                           |                                                                             |                                                                              |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 1. $13 \times 7\frac{1}{2} = ?$                                           | 4. $17 \times 10\frac{5}{12} = ?$                                           | 7. $102 \times 22\frac{1}{2} = ?$                                            |
| 2. $19 \times 8\frac{2}{10} = ?$                                          | 5. $21 \times 11\frac{3}{8} = ?$                                            | 8. $204 \times 34\frac{1}{8} = ?$                                            |
| 3. $23 \times 9\frac{4}{11} = ?$                                          | 6. $27 \times 12\frac{3}{4} = ?$                                            | 9. $468 \times 56\frac{1}{2} = ?$                                            |
| 10. $\begin{array}{r} 387 \\ \times 400\frac{1}{4} \\ \hline \end{array}$ | 12. $\begin{array}{r} 4060 \\ \times 2050\frac{1}{8} \\ \hline \end{array}$ | 14. $\begin{array}{r} 3579\frac{1}{16} \\ \times 4300 \\ \hline \end{array}$ |
| 11. $\begin{array}{r} 698 \\ \times 135\frac{5}{8} \\ \hline \end{array}$ | 13. $\begin{array}{r} 3050 \\ \times 2060\frac{1}{2} \\ \hline \end{array}$ | 15. $\begin{array}{r} 4987\frac{1}{11} \\ \times 2469 \\ \hline \end{array}$ |

**23. Oral Problems.**

- How many ounces in  $6\frac{1}{2}$  pounds?
- I sold  $3\frac{1}{2}$  yards of silk and  $2\frac{3}{4}$  yards of velvet. How many yards in all did I sell?
- From 60 take 24. Find  $\frac{1}{4}$  of the remainder.
- $\frac{3}{4}$  of 100 rods = ?
- $\frac{2}{3}$  of 81 yards = ?
- $(\frac{2}{3} \text{ of } 60) + 9 = ?$
- $\frac{1}{4}$  of 56 pounds = ?

8.  $\frac{3}{4}$  of a yard and 12 inches are how many inches?

9. If one-half a pound of soap costs 10 cents, what will three pounds cost?

10. John is going a journey of 100 miles; if he travels  $\frac{3}{4}$  of the distance in the cars and the rest in a coach, how many miles will he travel in the coach?

11. How many times must I fill my glass, which holds  $\frac{1}{2}$  a pint, to fill my pitcher, which holds a gallon?

12. If a boy is in school  $5\frac{1}{4}$  hours a day, how many hours is he in school in 200 days?

#### 24. Written Problems.

1. What is meant by  $\frac{5}{8}$  of any number or thing? Make a drawing to show what you mean.

2. What is the cost of  $15\frac{1}{4}$  acres of land at \$45 an acre?

3. Reduce  $\frac{2}{3}$ ,  $\frac{3}{4}$ ,  $\frac{5}{6}$ , and  $\frac{7}{8}$  to fractions having a common denominator.

4. What is the cost of a side of beef containing 252 pounds at  $9\frac{1}{4}$  cents a pound?

5. A hotel uses  $18\frac{3}{4}$  pounds of beef in a day. What will be the weekly bill at 22 cents a pound?

6. A man walks  $3\frac{3}{4}$  miles in one hour. How far can he walk in 9 hours?

7. From a piece of muslin containing  $37\frac{1}{2}$  yards, three pieces each measuring  $7\frac{1}{8}$  yards were sold. How much remained in the piece?

8. At \$7.86 a barrel, what will  $18\frac{5}{8}$  barrels of flour cost?

9. Bought 6 bushels of apples at  $62\frac{1}{2}$  cents a bushel, and sold them at  $12\frac{1}{2}$  cents a half-peck. What was the gain?

10. In a school containing 945 pupils  $\frac{4}{5}$  of the number were boys; how many boys in the school?

11. What is the cost of 15 acres of land at \$45 $\frac{1}{4}$  an acre?

12. If a quart of cream is worth 22 cents, what are two gallons worth?

13. At 9 cents a quart, what is the cost of  $2\frac{1}{2}$  gallons of vinegar?

14. What is the total quantity of molasses in 4 casks containing, respectively,  $40\frac{1}{4}$ ,  $25\frac{1}{8}$ ,  $27\frac{3}{8}$ , and  $55\frac{1}{2}$  gallons?

15. The Post-office Department bought 6670 pounds of twine at  $19\frac{1}{2}$  cents a pound; 372 pounds of sponge at  $65\frac{1}{2}$  cents a pound, and  $40\frac{1}{2}$  dozen of ink at \$2 a dozen. What was the total cost of the purchase?

#### DIVISION OF MIXED NUMBERS.

##### 25. Preliminary Exercises.

How many times is  $\frac{1}{2}$  of a dollar contained in \$1? How many times is  $\frac{1}{2}$  of a pint contained in 1 pint?  $\frac{1}{2}$  of a gallon in 1 gallon?

How many times is  $\frac{1}{2}$  of a dollar contained in \$2? In \$3? In \$5?

How many times is  $\frac{1}{2}$  of a dollar contained in \$1.50? In \$2.50? In \$3.50? In \$4.50?

How many times is 1 half contained in 3 halves? In 5 halves? In 7 halves? In 9 halves?

$$\frac{3}{2} \div \frac{1}{2} = ? \quad \frac{5}{2} \div \frac{1}{2} = ? \quad \frac{7}{2} \div \frac{1}{2} = ? \quad \frac{9}{2} \div \frac{1}{2} = ?$$

How many times is  $\frac{3}{2}$  contained in  $\frac{3}{2}$ ? In  $\frac{5}{2}$ ? In  $1\frac{1}{2}$ ? In  $2\frac{1}{2}$ ?

Divide  $1\frac{1}{2}$  by  $1\frac{1}{2}$ .  $4\frac{1}{2}$  by  $1\frac{1}{2}$ .  $7\frac{1}{2}$  by  $1\frac{1}{2}$ .  $10\frac{1}{2}$  by  $1\frac{1}{2}$ .

Divide 3 by  $1\frac{1}{2}$ . 6 by  $1\frac{1}{2}$ . 9 by  $1\frac{1}{2}$ . 12 by  $1\frac{1}{2}$ . 15 by  $1\frac{1}{2}$ .

Divide 5 by  $1\frac{1}{2}$ .  $6\frac{1}{2}$  by  $1\frac{1}{2}$ . 10 by  $1\frac{1}{2}$ .  $11\frac{1}{2}$  by  $1\frac{1}{2}$ . 15 by  $1\frac{1}{2}$ .

Divide  $\frac{3}{2}$  by  $\frac{3}{2}$ .  $\frac{5}{2}$  by  $\frac{3}{2}$ .  $1\frac{1}{2}$  by  $\frac{3}{2}$ .  $1\frac{1}{2}$  by  $\frac{3}{2}$ .  $2\frac{1}{2}$  by  $\frac{3}{2}$ .  
3 by  $\frac{3}{2}$ .  $3\frac{1}{2}$  by  $\frac{3}{2}$ .



**26. Written Exercises.**

1. Divide 250 by
- $12\frac{1}{2}$
- .

$$250 = 500 \text{ halves.} \quad 12\frac{1}{2} = 25 \text{ halves.}$$

$$500 \text{ halves} \div 25 \text{ halves} = 500 \div 25 = 20, \text{ Ans.}$$

$$\text{Proof : } 20 \times 12\frac{1}{2} = 250.$$

2. Divide
- $62\frac{1}{2}$
- by 25.

$$62\frac{1}{2} = 125 \text{ halves.} \quad 25 = 50 \text{ halves.}$$

$$125 \text{ halves} \div 50 \text{ halves} = 125 \div 50 = 2\frac{5}{10} = 2\frac{1}{2}, \text{ Ans.}$$

$$\text{Proof : } 25 \times 2\frac{1}{2} = 62\frac{1}{2}.$$

3. Divide
- $1387\frac{1}{2}$
- by
- $18\frac{3}{4}$
- .

$$18\frac{3}{4} = 75 \text{ fourths.}$$

Change  $1387\frac{1}{2}$  to fourths by multiplying by 4.

$$1387\frac{1}{2} \times 4 = 5550; \text{ that is, } 1387\frac{1}{2} = 5550 \text{ fourths.}$$

$$75 \text{ fourths is contained in } 5550 \text{ fourths } 74 \text{ times.}$$

$$\text{Ans. } 74$$

$$75 \overline{)5550}$$

$$\underline{525}$$

$$300$$

$$\underline{300}$$

*Reduce the dividend and the divisor to improper fractions of the same denominator, and divide the numerator of the dividend by the numerator of the divisor. Prove the correctness of the answer by multiplying the quotient by the divisor.*

**27. Written Exercises.**

Divide:

1.  $60 \div \frac{1}{2}$

11.  $75 \div 12\frac{1}{2}$

21.  $62\frac{1}{2} \div 12\frac{1}{2}$

2.  $60 \div 1\frac{1}{2}$

12.  $150 \div 12\frac{1}{2}$

22.  $187\frac{1}{2} \div 12\frac{1}{2}$

3.  $60 \div \frac{1}{3}$

13.  $75 \div 6\frac{1}{4}$

23.  $81\frac{1}{4} \div 6\frac{1}{4}$

4.  $60 \div 1\frac{1}{3}$

14.  $150 \div 6\frac{1}{4}$

24.  $193\frac{3}{4} \div 6\frac{1}{4}$

5.  $60 \div \frac{1}{4}$

15.  $62 \div 15\frac{1}{2}$

25.  $77\frac{1}{2} \div 15\frac{1}{2}$

6.  $60 \div 1\frac{2}{3}$

16.  $105 \div 17\frac{1}{2}$

26.  $192\frac{1}{2} \div 17\frac{1}{2}$

7.  $60 \div \frac{2}{3}$

17.  $69 \div 5\frac{3}{4}$

27.  $97\frac{3}{4} \div 5\frac{3}{4}$

8.  $60 \div 2\frac{1}{2}$

18.  $93 \div 7\frac{3}{4}$

28.  $193\frac{3}{4} \div 7\frac{3}{4}$

9.  $60 \div \frac{3}{4}$

19.  $100 \div 33\frac{1}{3}$

29.  $166\frac{2}{3} \div 33\frac{1}{3}$

10.  $60 \div 3\frac{1}{3}$

20.  $150 \div 16\frac{2}{3}$

30.  $133\frac{1}{3} \div 16\frac{2}{3}$

31.  $60\frac{1}{2} \div 2$

34.  $87\frac{1}{2} \div 6\frac{1}{4}$

37.  $60 \div 3\frac{3}{4}$

32.  $60 \div 7\frac{1}{2}$

35.  $62\frac{1}{2} \div 6\frac{1}{4}$

38.  $24\frac{1}{2} \div 1\frac{1}{2}$

33.  $15\frac{3}{4} \div 1\frac{1}{4}$

36.  $60\frac{1}{4} \div 3$

39.  $87\frac{1}{2} \div 8\frac{3}{4}$

## 28. Oral Problems.

1. I paid 18 cents for  $1\frac{1}{2}$  pounds of lard. What is the price per pound?

36 cents for 3 pounds.

2. At  $\frac{3}{4}$  dollar per yard, how many yards of silk can be bought for \$9?

36 quarter dollars  $\div$  3 quarter dollars.

3. If one fish cost 25 cents, how much would  $2\frac{1}{2}$  fish cost?

4. A man bought 30 apples at the rate of 3 for 5 cents. How much did he give for them?

5. If I pay 6 cents for a dozen apples, how much does each apple cost?

6. How many times is  $4\frac{1}{2}$  contained in 27?

7. If  $2\frac{1}{2}$  bushels of oats will keep a horse one week, how long will 18 bushels keep him?

8. If \$97 is  $\frac{1}{7}$  of a sum of money, what is that sum?

9. What is the cost of 12 doz. eggs at the rate of 2 eggs for 3 cents?

10. If 3 boys can cut a cord of wood in 8 hours, how long will it take 4 boys to cut a cord?

11. If  $\frac{1}{3}$  of a melon costs 15 cents, what will two melons cost at the same rate?

12. It takes  $2\frac{1}{2}$  yards of cloth for a pair of trousers. How many pairs can be made from 30 yards of cloth?

13. Paid \$12.90 for 3 pieces of lace. How much did each cost?

14. If 3 straw hats cost 63 cents, what will be the cost of 5?

## 29. Written Problems.

1. A farmer distributed 15 bushels of corn among several persons, giving them  $1\frac{3}{5}$  bushels apiece; among how many persons did he divide it?

2. A man bequeathed to his son \$3500, which was  $\frac{5}{7}$  of what he left his wife. How much did he leave his wife?

SUGGESTION. —  $\frac{5}{7}$  of wife's share = \$3500. Multiplying by 7:

5 times wife's share = \$24,500.

3. If  $\frac{3}{8}$  of a farm is valued at \$1728, what is the value of the whole?

4. A man walks  $4\frac{2}{3}$  miles in one hour, how far can he walk in 9 hours?

5. At  $\frac{3}{4}$  of a cent a foot, how many feet of wire can be bought for \$1.26?

6. The sum of  $69\frac{1}{2}$  dollars was divided equally among 5 men; what was each one's share?

7. At  $\frac{7}{8}$  dollars per yard, how many yards of cloth can be purchased for \$98?

8. In how many days can a horse eat 66 bushels of oats if he eats  $\frac{3}{4}$  of a bushel a day?

9. A man bought chairs at  $4\frac{3}{4}$  dollars apiece for 114 dollars, and then sold them at  $6\frac{1}{4}$  dollars apiece; how much did he gain?

10. A man sold  $9\frac{5}{8}$  bushels of seed for \$61.60; find the price per bushel.

11. What part of 24 is 3? What part of  $24\frac{1}{2}$  is  $3\frac{1}{2}$ ?

12. What would be the cost of  $24\frac{1}{2}$  pounds of beans at the rate of 11 cents for  $3\frac{1}{2}$  pounds?

**30. Notation and Numeration.**

The largest number that can be written with six figures is 999,999.

1,000,000, is called one million.

Write in figures two million. Three million. Four million. Six million. Eight million. Ten million.

**31. Read the following :**

- |              |                |                 |
|--------------|----------------|-----------------|
| 1. 1,234,567 | 6. 11,034,065  | 11. 30,100,021  |
| 2. 3,000,560 | 7. 14,602,500  | 12. 35,000,600  |
| 3. 5,009,008 | 8. 17,386,925  | 13. 401,023,160 |
| 4. 7,090,070 | 9. 20,007,316  | 14. 760,030,020 |
| 5. 9,843,000 | 10. 25,000,005 | 15. 980,750,000 |

**32. Write in figures :**

1. Seventy-eight million, one hundred eight thousand, ninety-six.

2. Three million, eight.

3. Fourteen million, seven thousand, five.

4. Nine hundred eighty-seven thousand, six hundred fifty-four.

5. Twenty million, thirty thousand, forty.

6. Three hundred seven million, nine hundred four thousand, six.

7. Nine hundred ninety-nine million, nine hundred ninety-nine thousand, nine hundred ninety-nine.

8. Four hundred seventy-six million, three hundred thousand.

9. Thirty-four thousand, eighteen.

10. Sixty-four million, thirty-two thousand, sixteen.

11. Add the foregoing.

**REVIEW OF FUNDAMENTAL OPERATIONS.**

Practice in the fundamental operations should not be neglected. Business men complain that elementary and high school graduates cannot add.

Read the following numbers. Add each column.

1.	27,083,549	2.	508,900,007	3.	243,576,908
	3,006,005		4,629,880		5,987,600
	20,080,070		25,936,097		380,070
	1,647,893		134,870,603		68,000
	206,045		59,009,300		593,056
	73,000		7,000,004		2,384,672
	180,059		686,909		59,876,004
	<hr/>		<hr/>		<hr/>
4.	9,256,874	5.	348	6.	7,293
	863,052		2,967		82,538
	24,635,998		36,847		786,324
	7,007,007		243,837		94,649
	6,875,634		183,634		256,834
	3,987,456		986,246		3,983,387
	35,068		8,216		54,619
	705		586,237		760,888
	<hr/>		<hr/>		<hr/>

**33. Oral Exercises.**

Give answers:

- |                    |                     |                     |                     |
|--------------------|---------------------|---------------------|---------------------|
| 1. $1200 \times 6$ | 6. $1300 \times 9$  | 11. $2100 \times 4$ | 16. $1400 \times 8$ |
| 2. $1800 \times 4$ | 7. $2300 \times 3$  | 12. $1400 \times 6$ | 17. $2400 \times 4$ |
| 3. $2500 \times 3$ | 8. $3200 \times 2$  | 13. $4100 \times 2$ | 18. $1300 \times 7$ |
| 4. $1700 \times 5$ | 9. $1500 \times 4$  | 14. $1600 \times 5$ | 19. $1200 \times 9$ |
| 5. $1400 \times 7$ | 10. $1200 \times 8$ | 15. $2200 \times 3$ | 20. $6300 \times 2$ |

**34. Written Exercises.**

Multiply:

- |                                   |                                         |
|-----------------------------------|-----------------------------------------|
| 1. $9,207 \times 3014$            | 7. $95 \times 95 \times 95$             |
| 2. $5,482 \times 798\frac{1}{2}$  | 8. $185 \times 19 \times 78$            |
| 3. $5,290 \times 6075$            | 9. $87\frac{1}{4} \times 23 \times 36$  |
| 4. $9,204 \times 678\frac{1}{2}$  | 10. $706 \times 304 \times 509$         |
| 5. $75,074 \times 395$            | 11. $48\frac{3}{8} \times 32 \times 74$ |
| 6. $68,431 \times 924\frac{1}{2}$ | 12. $538 \times 247 \times 125$         |

**35. Oral Exercises.**

Divide:

- |                    |                      |                       |
|--------------------|----------------------|-----------------------|
| 1. $960 \div 240$  | 6. $8400 \div 2100$  | 11. $10800 \div 1200$ |
| 2. $780 \div 260$  | 7. $8600 \div 4300$  | 12. $10400 \div 1300$ |
| 3. $960 \div 480$  | 8. $8800 \div 2200$  | 13. $6000 \div 1500$  |
| 4. $720 \div 180$  | 9. $9600 \div 3200$  | 14. $5700 \div 1900$  |
| 5. $2170 \div 310$ | 10. $9900 \div 3300$ | 15. $12000 \div 2400$ |

The foregoing exercises are given as a preparation for the long division drill that follows. Each of the above set has an exact quotient, easily determined at sight.

The object of the following set is to drill pupils to obtain rapidly the correct quotient figure in a long division example. A pupil giving 4 as the answer to No. 1 should be asked to give the product of 241 by 4.

**36. Long division drill. (Omit remainders.)**

- |                    |                        |                        |
|--------------------|------------------------|------------------------|
| 1. $960 \div 241$  | 6. $8,400 \div 2110$   | 11. $10,800 \div 1205$ |
| 2. $779 \div 260$  | 7. $8,500 \div 4300$   | 12. $10,300 \div 1300$ |
| 3. $959 \div 480$  | 8. $8,800 \div 2199$   | 13. $6,100 \div 1550$  |
| 4. $720 \div 181$  | 9. $9,599 \div 3199$   | 14. $5,700 \div 1899$  |
| 5. $1160 \div 130$ | 10. $10,000 \div 3330$ | 15. $12,020 \div 2410$ |

**37. Divide:**

- |                        |                          |
|------------------------|--------------------------|
| 1. $34,463 \div 370$   | 7. $703,705 \div 12,345$ |
| 2. $823,150 \div 1298$ | 8. $420,135 \div 6,789$  |
| 3. $639,712 \div 624$  | 9. $370,088 \div 5,986$  |
| 4. $345,738 \div 7210$ | 10. $510,940 \div 4,900$ |
| 5. $861,704 \div 351$  | 11. $639,215 \div 9,783$ |
| 6. $857,384 \div 3004$ | 12. $345,678 \div 7,095$ |

**38. Sight Exercises.**

NOTE. — First, combine the quantities within the parentheses, ( ); next, complete the combinations within the brackets, [ ], if any; then perform the remaining operations.

$$28 + (40 + 2) = 28 + 20$$

$$[30 + (6 + 2)] \times 5 = [30 + 8] \times 5 = 10 \times 5$$

Perform indicated operations at sight:

- |                                           |                                                |
|-------------------------------------------|------------------------------------------------|
| 1. $18 + (30 \times 4)$                   | 7. $\frac{1}{2}$ of $(240 + 60)$               |
| 2. $7 + (2 \times 8) - 4$                 | 8. $(7 + 2) \times (8 - 4)$                    |
| 3. $[(7 + 2) \times 8] - 4$               | 9. $7 + [2 \times (8 - 4)]$                    |
| 4. $1 - (\frac{1}{2} + \frac{1}{3})$      | 10. $1 - \frac{1}{2} + \frac{1}{3}$            |
| 5. $(6 \times \frac{1}{2}) + \frac{1}{3}$ | 11. $6 \times (\frac{1}{2} + \frac{1}{3})$     |
| 6. $\frac{1}{2}$ of $\frac{1}{3}$ of 600  | 12. $\frac{2}{3} \times 12 \times \frac{1}{2}$ |

**SPECIAL DRILLS.**

NOTE. — In adding, subtracting, and multiplying without using the pencil, it is inadvisable to begin with the units: 58 and 34, for instance, are more readily combined mentally, by adding 58 and 30 (88) and 4. In the recitation, the pupil should say 88, 92; or 92, merely.

$$630 + 280 = 630 + 200 + 80.$$

**39. Give sums:**

- |         |         |           |          |
|---------|---------|-----------|----------|
| 56 + 25 | 32 + 48 | 750 + 190 | 225 + 54 |
| 47 + 47 | 29 + 28 | 390 + 120 | 315 + 21 |
| 22 + 68 | 65 + 26 | 480 + 150 | 437 + 60 |

# Review of Fundamental Operations. 21

## 40. Give remainders:

$$92 - 58 = 92 - 50 - 8. \text{ Say } 42, 34.$$

$$840 - 280 = 840 - 200 - 80. \text{ Say } 640, 560.$$

81 - 56	750 - 190	750 - 560	279 - 54
94 - 47	510 - 120	510 - 390	386 - 63
60 - 28	630 - 150	630 - 480	457 - 37
72 - 39	820 - 160	820 - 660	568 - 25

## 41. Give products:

$$87 \times 2 = (80 \times 2) + (7 \times 2). \text{ Say, } 160, 174.$$

410 $\times$ 6	83 $\times$ 7	43 $\times$ 5	12 $\times$ 70
310 $\times$ 9	99 $\times$ 2	26 $\times$ 7	18 $\times$ 30
420 $\times$ 4	65 $\times$ 3	24 $\times$ 8	16 $\times$ 40
630 $\times$ 3	49 $\times$ 4	22 $\times$ 9	13 $\times$ 50
740 $\times$ 2	37 $\times$ 5	18 $\times$ 11	11 $\times$ 60

## 42. Give quotients:

168 $\div$ 3	168 $\div$ 56	1470 $\div$ 7	1470 $\div$ 210
196 $\div$ 4	196 $\div$ 49	2790 $\div$ 9	2790 $\div$ 310
190 $\div$ 5	190 $\div$ 38	1680 $\div$ 4	1680 $\div$ 420
192 $\div$ 6	192 $\div$ 32	1890 $\div$ 3	1890 $\div$ 630
196 $\div$ 7	196 $\div$ 28	1480 $\div$ 2	1480 $\div$ 740

## 43. Give answers:

$2\frac{1}{2} + 1\frac{1}{8}$	$1\frac{1}{8} - \frac{1}{2}$	$\frac{3}{8}$ of 66	$12\frac{1}{2} + \frac{1}{2}$
$2\frac{1}{4} + 1\frac{1}{8}$	$2\frac{1}{4} - 1\frac{1}{8}$	$84 \times \frac{3}{4}$	$8\frac{1}{4} + \frac{3}{4}$
$2\frac{1}{8} + 1\frac{1}{2}$	$3\frac{1}{8} - 2\frac{1}{2}$	$\frac{4}{5}$ of 100	$5\frac{1}{8} + \frac{3}{8}$
$2\frac{1}{8} + 1\frac{1}{8}$	$4\frac{1}{8} - 3\frac{1}{8}$	$186 \times \frac{5}{6}$	$3\frac{1}{8} + \frac{3}{8}$
$2\frac{1}{8} + 1\frac{1}{8}$	$5\frac{1}{4} - 4\frac{3}{4}$	$\frac{5}{6}$ of 120	$4\frac{1}{8} + \frac{3}{8}$



**44. Oral Problems.**

1. Paid 59¢ for muslin and 25¢ for trimming. How much was paid for both?
2. A boy had 75¢. How much had he after spending 25¢ for a knife and 15¢ for a ball?
3. If 8 pounds of raisins cost \$1.04, what is the price per pound?
4. At \$1.89 per yard of silk, what will be the cost of  $\frac{1}{8}$  of a yard?
5. If 32 pounds of flour cost 96 cents, how many pounds can be bought for 60 cents?
6. One girl has 16 cents, another has 24 cents, a third has 8 cents. How many dolls at 16 cents each can be bought with their money?
7. What will be the weight of 3 bushels of corn, weighing 56 pounds per bushel?
8. How many ounces in 9 pounds avoirdupois?
9. How many pounds in 8 packages, each weighing 10 ounces?
10. Find the cost of 3 pounds and 2 ounces of butter at 32 cents per pound.
11. Bought 4 pounds of sugar at 6 cents a pound, and a pound of butter at 36 cents. How much change from \$1?
12. Four boys have 144 marbles among them. If the marbles were equally divided, how many would each have?
13. A man earns \$100 per month, and spends \$76. How much does he save?
14. If a man saves \$32 per month, how many months will it take him to save \$960?
15. Paid \$27.90 for 9 jackets. What did they cost apiece?

16. Mr. B's farm contains 520 acres. How many acres will he have left after selling 180 acres?

17. William's kite string is 435 yards long, John's is 62 yards longer. What is the length of John's string?

18. A farmer raised 168 bushels of grain. He sold  $\frac{1}{4}$  of it. How many bushels did he sell?

19. A piece of ribbon measuring  $6\frac{1}{4}$  yards is cut into pieces a quarter of a yard long. How many pieces are there?

20. If it takes  $18\frac{3}{4}$  yards of cloth to make 3 suits, how many yards does it take for 1 suit?

21. James has 150 marbles, Thomas has  $\frac{2}{3}$  as many. How many marbles have both?

22. A newsdealer received \$6.36 for papers sold at 3 cents each. How many papers did he sell?

23. If it takes  $4\frac{1}{2}$  days for one man to do a piece of work, how long will it take 2 men to do the same work?

24. A farm is divided into 4 fields, each containing 49 acres. How many acres are there in the farm?

25. From a piece of cloth containing  $10\frac{1}{2}$  yards,  $5\frac{3}{4}$  yards are sold. How many yards are left?

26. Find the cost of 28 pounds coffee at  $\$ \frac{1}{4}$  per pound.

27. How much does a farmer receive for 28 cows which he sells at \$30 each?

28. Find the number of hours in a week.

29. How many pieces, each three-quarters of a yard long, can be cut from six yards of wire?

30. 3600 seconds are equal to how many minutes?

31. If 25 yards of material are needed for a dress, how many yards will be required for 30 dresses?

32. At 7 for a cent, what will 98 marbles cost?

**45. Written Problems.**

1. The sum of three numbers is 150. Two of the numbers are 68 and 43. What is the third?

$$68 + 43 + ? = 150$$

2. The divisor is 24; the dividend is 264. Find the quotient.

3. The product is 228; the multiplicand is 19. What is the multiplier?

$$19 \times ? = 228$$

4. The minuend is 175; the subtrahend is 87. What is the remainder?

5. The remainder is 92; the subtrahend is 89. Find the minuend.

$$? - 89 = 92$$

6. The minuend is 176, and the remainder is 99. What is the subtrahend?

7. The multiplier is 15; the multiplicand is 46. What is the product?

8. The multiplier is 16; the product is 272. What is the multiplicand?

9. The dividend is 300; the divisor is 17. Find the remainder.

10. The quotient is 15; the remainder is 3; the divisor is 8. What is the dividend?

$$\begin{array}{r} 8 \overline{) ?} \\ 15 \end{array}$$

11. The dividend is 273; the quotient is 21. What is the divisor?

12. The dividend is 267; the quotient is 13; the remainder is 7. What is the divisor?

$$\begin{array}{r} ? \overline{) 267} \\ 13 \end{array}$$

13. How many acres of land could you buy for \$76,225, if one acre cost \$37?

## NOTATION OF DECIMALS.

46. A *decimal fraction* is one in which the unit is divided into tenths, hundredths, thousandths, etc.

## 47. Preliminary Exercises.

In the number 25, what does the 2 stand for?

In the number 467, what does the 4 represent? The 6? The 7?

In the number 33,333, give the value of the first 3 (commencing at the left). Of the second. Of the third. Of the fourth. Of the fifth.

The last 3 is what part of the number represented by the fourth 3? The third 3 is what part of the second? Each 3 is what part of the 3 to its left? Upon what does the value of each 3 in this number depend?

In the number XXXIII, what is the value of the first X? Of the second? Of the third?

When we write \$784.365, the 7 stands for seven times how many dollars? The 8 for eight times how many dollars? The 4 for four times how many dollars? The 3 stands for three times what part of a dollar? The 6 stands for six times what part of a dollar? The 5 stands for five times what part of a dollar?

Hundreds.	Tens.	Units.	Decimal Point.	Tenths.	Hundredths.	Thousandths.
7	8	4	.	3	6	

784.365 is read 784 *and* 365 thousandths.

37.5 is read 37 *and* 5 tenths.

6.492 is read 6 *and* 492 thousandths.

400.75 is read 400 units *and* 75 hundredths.

NOTE.—In reading a number containing an integer and a decimal, the word *and* may be placed between the two, as is shown above. To avoid mistakes, the word *units* should be used after the integer in reading such numbers as 200.005. Say: Two hundred units *and* five thousandths.

48. Read the following:

1. .7	5. 3.275	9. 100.025
2. 34.9	6. 32.4	10. .125
3. .36	7. 1.025	11. .005
4. .95	8. .35	12. 1.348

49. Express in decimals:

1. 7 tenths.
2. 36 and 47 thousandths.
3. One hundred twenty-five thousandths.
4. One hundred units and twenty-five thousandths.
5. 47 hundredths.
6. Four hundred units and six tenths.
7. Four hundred six thousandths.
8. 3 and 56 hundredths.
9. 65 hundredths.
10. 6 and 5 tenths.

NOTE. — Since  $\frac{50}{100}$  equals  $\frac{5}{10}$ ,  $.50 = .5$ . The cipher at the right of  $.50$  has, therefore, no value.  $\frac{700}{1000} = \frac{7}{10}$ ;  $.700$  is, therefore, the same as  $.7$ . In giving answers, reject ciphers at the right of the decimal.

#### ADDITION OF DECIMALS.

50. Add:

1. .7	2. 3.84	3. 28.978	4. 5.6
4.18	68.075	.28	.387
.005	.5	5.375	26.93
<u>5.67</u>	<u>24.698</u>	<u>18.758</u>	<u>8.754</u>
10.555	97.113		

*Write the numbers so that the decimal points stand in a column. Add as in whole numbers, and place the point in the sum directly under the points in the addends.*

**51. Written Exercises.**

1.  $.027 + 1.39 + 48.6 + 72.978$
2.  $234.96 + .675 + 50.4 + 6.02 + 1.001$
3.  $3.047 + 54.79 + .097 + .76 + .862$
4.  $.8 + .38 + .479 + 27.87 + 375$
5.  $.445 + 34.75 + 306.973 + .004 + 48.56$
6.  $.81 + 12.654 + 234.79 + 8.6 + .603 + 42.96$
7.  $45.78 + .237 + 6.987 + 18 + 372.003 + 37.5$
8.  $4.745 + 36.58 + 725.894 + 9.87 + 75.357 + 86.74$
9.  $59.3 + 83 + 9.64 + 48.565 + 6.98 + 8.795 + 963.826$
10.  $13.387 + 72.563 + .7 + .603 + 7.245 + .483 + 9.25$
11.  $8.3 + 2.576 + 3.42 + 1.5 + 6.279 + .003 + 1.417$

**SUBTRACTION OF DECIMALS.****52. From 37 take 3.7.**

$$\begin{array}{r}
 37 \text{ may be written } 37.0 \\
 \text{subtract } 3.7 \\
 \hline
 33.3 \text{ Ans.}
 \end{array}$$

In practice, the pupil should not waste time in writing the unnecessary ciphers at the right of the decimals in the minuend.

$$\begin{array}{r}
 182.01 \\
 -4.624 \\
 \hline
 177.386
 \end{array}$$

$$\begin{array}{r}
 1. \\
 -.009 \\
 \hline
 .991
 \end{array}$$

$$\begin{array}{r}
 28.6 \\
 -1.003 \\
 \hline
 27.597
 \end{array}$$

*Write the numbers so that the decimal point in the subtrahend stands directly under the decimal point in the minuend. Subtract as in whole numbers, and place the point in the remainder under the points above.*

**53. Written Exercises.**

Find answers:

1.  $1 - .057$

3.  $6 - 3.324$

5.  $3 - 1.568$

2.  $1 - .245$

4.  $4 - 2.491$

6.  $7 - 4.736$

- |                        |                       |
|------------------------|-----------------------|
| 7. $3.587 - 1.34$      | 14. $681.38 - 94.572$ |
| 8. $91.352 - 72.456$   | 15. $1000 - 465.874$  |
| 9. $42.007 - 17.658$   | 16. $30.053 - 18.7$   |
| 10. $68.217 - 39.4$    | 17. $2568.91 - 1925$  |
| 11. $9.34 - 5.672$     | 18. $1.234 - .825$    |
| 12. $45.268 - 23.068$  | 19. $473.5 - 298.572$ |
| 13. $219.843 - 187.95$ | 20. $57.083 - 44.95$  |

**MULTIPLICATION OF A DECIMAL BY AN INTEGER.**

54. Three times 3 tenths equals how many tenths?

$$.3 \times 3 = \text{what?} \quad .3 \times 4 = ? \quad .3 \times 12 = ?$$

1. Multiply 2.7 by 8.

$$\begin{array}{r} 8 \text{ times } 7 \text{ tenths} = 56 \text{ tenths} = 5.6. \text{ Write } .6. \text{ 8 times } \\ 2 = 16; \text{ carry } 5. \end{array} \quad \begin{array}{r} 2.7 \\ \times 8 \\ \hline \end{array}$$

Ans. 21.6

2. Multiply .275 by 12.

$$\begin{array}{r} \text{The product of 275 thousandths by 12 is 3300 thousandths,} \\ \text{which equals 3 and 300 thousandths, or 3 and 8 tenths.} \end{array} \quad \begin{array}{r} .275 \\ \times 12 \\ \hline \end{array}$$

Ans. 3.3

*Multiply as in whole numbers, and point off in the product decimal places equal to the number in the multiplicand, rejecting unnecessary ciphers at the right of the decimal.*

**55. Written Exercises.**

Multiply:

- |                     |                       |
|---------------------|-----------------------|
| 1. $.36 \times 3$   | 6. $.048 \times 375$  |
| 2. $57.2 \times 7$  | 7. $12.67 \times 300$ |
| 3. $6.4 \times 122$ | 8. $6.57 \times 9$    |
| 4. $.67 \times 4$   | 9. $8.76 \times 43$   |
| 5. $38.4 \times 25$ | 10. $.005 \times 360$ |

**56. Oral Exercises.**

Give products:

1.  $6.84 \times 10$

6.  $.961 \times 100$

2.  $68.4 \times 10$

7.  $.57 \times 1000$

3.  $3.28 \times 10$

8.  $.09 \times 1000$

4.  $5.71 \times 100$

9.  $.026 \times 100$

5.  $5.71 \times 1000$

10.  $5.17 \times 10$

NOTE. — The pupil should deduce the rule for multiplying a decimal by 10, 100, 1000.

**57. To multiply an integer by a decimal.**

Multiply 35 by 6.4.

$$\begin{array}{r} 35 \\ 6.4 \\ \hline 140 \\ 210 \\ \hline 224.0 \end{array}$$

Since the product of 35 by 6.4 is equal to the product of 6.4 by 35, there will be one decimal place in the product.

*Ans.* 224.

$$\begin{array}{r} 6.4 \\ 35 \\ \hline 32.0 \\ 192 \\ \hline 224.0 \end{array}$$

*In multiplying an integer by a decimal, or a decimal by an integer, point off in the product as many decimal places as there are decimal places in the multiplier or the multiplicand.*

**58. Multiply:**

1. 122 by 6.4

6. 5430 by .8

2. 512 by .003

7. 748 by .97

3. .056 by 987

8. 964 by .347

4. 97 by .005

9. 570 by .11

5. 275 by 1.2

10. 570 by 1.1



## DIVISION OF A DECIMAL BY AN INTEGER.

## 59. Preliminary Exercises.

1.  $8.64 \div 2$

6.  $.666 \div 6$

2.  $48.24 \div 4$

7.  $.048 \div 8$

3.  $.465 \div 4$

8.  $.81 \div 9$

4.  $8.40 \div 5$

9.  $.12 \div 5$

5.  $8.4 \div 5$

10.  $.34 \div 4$

60. Where it is necessary, ciphers may be annexed to the right of the decimal in the dividend.

1.  $8 \overline{) .12}$   
 $\underline{.015}$

2.  $15 \overline{) .06}$   
 $\underline{.004}$

5.  $64 \overline{) 120.}$   
 $\underline{64}$

3.  $125 \overline{) 1.50}$   
 $\underline{1.25}$   
 $\underline{.250}$   
 $\underline{.250}$

4.  $21 \overline{) 8.673}$   
 $\underline{8.4}$   
 $\underline{.27}$   
 $\underline{.21}$   
 $\underline{.063}$   
 $\underline{.063}$

$$\begin{array}{r} 1.875 \\ 64 \overline{) 120.} \\ \underline{64} \\ 56.0 \\ 51.2 \\ \underline{4.80} \\ 4.48 \\ \underline{.320} \\ .320 \end{array}$$

*In dividing a decimal by an integer, point off in the quotient as many decimal places as there are decimal places in the dividend (including the ciphers annexed).*

NOTE. — In practice, however, the decimal point may be placed in the quotient under (or over) the decimal point in the dividend.

## 61. Written Exercises.

Divide:

1.  $25 \overline{) 1.00}$

6.  $11 \overline{) 70.07}$

2.  $4 \overline{) 21.80}$

7.  $24 \overline{) 36.6}$

3.  $8 \overline{) .2}$

8.  $18 \overline{) .576}$

4.  $13 \overline{) 3.913}$

9.  $25 \overline{) 11.1}$

5.  $12 \overline{) 48.12}$

10.  $32 \overline{) 62.000}$

**62. Perform the indicated divisions:**

$$\frac{1}{25} = 1 \div 25$$

$$25 \overline{)1.00}$$

1.  $\frac{1}{4} =$

6.  $\frac{7}{125} =$

2.  $\frac{1}{8} =$

7.  $\frac{100}{82} =$

3.  $\frac{4}{5} =$

8.  $\frac{180}{75} =$

4.  $\frac{4}{50} =$

9.  $\frac{5000}{84} =$

5.  $\frac{3}{8} =$

10.  $\frac{1}{16} =$

**63. Give quotients at sight:**

1.  $932 \div 100$

6.  $684 \div 100$

2.  $86 \div 1000$

7.  $57.6 \div 10$

3.  $328 \div 10$

8.  $24.3 \div 100$

4.  $9 \div 1000$

9.  $8.75 \div 10$

5.  $48 \div 1000$

10.  $932.5 \div 100$

NOTE. — The pupil should deduce the rule for dividing by 10, 100, 1000.

**64. Written Problems.**

1. A man had 10.5 yards of cloth, and used 4.125 yards to make a coat. How many yards did he have left?

2. Find the cost of 2.578 acres of land, at \$ 37 an acre.

3. Find the amount of .87 and 8.7. Find the difference between .906 and 90.6.

4. Write in figures: Seventy-six thousand four hundred nine, and eighty-two thousandths. Nine hundred thousand nine hundred units, and thirty-one hundredths.

5. A franc is 19.3 cents. Find the cost in United States money of goods amounting to 1250 francs.

6. A merchant bought 1800 meters of silk. How many yards did he buy, a meter being 39.37 inches?

7. A kilogram is 2.2046 pounds. What is the difference in weight between the English ton of 2240 pounds and a French ton of 1000 kilograms?

8. A cubic foot of water weighs 1000 ounces. How many pounds does a cubic foot of gold weigh, gold being 19.4 times as heavy as water?

9. There are 128 cubic feet in a cord. How many tons of 2000 pounds are there in a cord of pine wood, the latter being .66 times as heavy as water?

10. A man buys three plots of ground containing 35.27, 17.8, and 40.375 acres, respectively. Find the total cost at \$36 per acre.

11. How many pints are there in 2.375 gallons?

12. What decimal of a peck is a quart?

13. What will be the cost of carrying 468 tons of coal at \$0.125 per ton?

14. A farmer sold one-eighth of his farm of 224.2 acres at \$62.50 per acre. How much did he receive for it?

### UNITED STATES MONEY.

65. Learn the following table:

10 mills = 1 cent.

100 cents = 1 dollar.

1 dime = 10 cents.

1 eagle = 10 dollars.

$\left\{ \begin{array}{l} 5 \text{ cents} = 1 \text{ nickel} \\ 25 \text{ " } = 1 \text{ quarter} \\ 50 \text{ " } = \text{half dollar} \\ 100 \text{ " } = \text{dollar} \end{array} \right.$

### ADDITION AND SUBTRACTION OF UNITED STATES MONEY.

66. Add the following without placing the amounts in columns:

1. \$8.34, \$40.39, \$638.27, \$594.38, \$1.97.

2. \$0.03, \$8.05, \$600.00, \$38.72, \$198.52, \$0.63.

*This is the first money table that has been given, is it not time for the children to know about a nickel, quarter, and dollar?*

3. \$432.84, \$96.25, \$3.64, \$782.46, \$800.06, \$6.50.
4. \$3.60, \$40.05, \$91.86, \$350.48, \$84.00, \$287.63.
5. \$98.27, \$0.60, \$600.39, \$8.09, \$37.38, \$503.07.
6. \$202.97, \$42.23, \$453.60, \$7.18, \$63.54, \$0.37.
7. \$8.43, \$0.54, \$2.57, \$85.13, \$425.31, \$8.27.
8. \$486.54, \$84.62, \$1.96, \$8.13, \$35.84, \$236.49.
9. \$83.61, \$523.00, \$23.04, \$0.86, \$35.82, \$584.60.
10. \$34.80, \$93.54, \$200.41, \$324.86, \$50.14, \$8.75.

The foregoing examples may be added directly from this book or from the blackboard, the pupils writing on their slates or papers nothing but the answers.

67. Subtract the following without rearranging them. Find the sum of the minuends, the sum of the subtrahends, and the sum of the remainders.

1. \$1,000.00 — \$876.49 =
2. \$549.37 — \$99.89 =
3. \$345.93 — \$76.04 =
4. \$1786.08 — \$1097.19 =
5. \$345.00 — \$187.23 =
6. 

---

 ? — ? = ?
7. \$3545.37 — \$966.38 =
8. \$82.46 — \$7.59 =
9. \$5074.02 — \$4987.63 =
10. \$77.84 — \$9.88 =
11. \$4680.35 — \$4679.46 =
12. 

---

 ? — ? = ?

**MULTIPLICATION OF UNITED STATES MONEY.**

68. Find the cost of:

1. 197 barrels of flour, at \$ 5.66 per barrel.
2. 486 bushels of wheat, at \$ 1.04 per bushel.
3. 237 tons of plaster, at \$ 6.72 per ton.
4. 809 tons of hay, at \$ 11.45 per ton.
5. 74 carloads of bran, at \$ 20.62½ per load.
6. 208 sheep, at \$ 4.65 per head.
7. 673 barrels of mackerel, at \$ 10.60 per barrel.
8. 984 bushels of onions, at \$ 1.09 per bushel.
9. 99 pounds of butter, at 24 cents per pound.
10. 208 pounds of coffee, at 28 cents per pound.

69. What will be the cost of 157 pounds of sugar, at 5¢ per pound.

At 5¢ per pound 157 pounds will cost 157 times 5¢. In practice, however, we multiply 157 by the smaller number 5.

Ans. \$ 7.85.

157
5
785

11. 1376 yards of muslin, at 6¼¢.
12. 2084 bushels of corn, at 47½¢.
13. 1864 pounds of beef, at 5½¢.
14. 988 pounds of turkeys, at 13½¢.
15. 296 bushels of potatoes, at 47½¢.
16. 1272 pounds of dried apples, at 2¼¢.
17. 488 pounds of lard, at 10¾¢.
18. 2240 pounds of sugar, at 4½¢.
19. 5176 pounds of wool, at 30¼¢.
20. 4892 bushels of wheat, at 99¼¢.

## DIVISION OF UNITED STATES MONEY.

## 70. Oral Exercises.

How often is 1 quart contained in 1 gallon? 1 pint in 1 quart? 2 quarts in 1 gallon? 1 inch in 1 foot? 2 inches in 1 foot? 3 inches in 1 foot? 4 inches in 1 foot? 6 inches in 1 foot? 6 inches in 2 feet? 8 inches in 2 feet? 1 ounce in 1 pound? 1 ounce in 2 pounds? 4 ounces in 2 pounds? 1 fourth in 1 half? 1 third in 1?

How often is 1 cent contained in \$1? 2 cents in a dollar? 4 cents in 2 dollars? 25 cents in 25 dollars?

$$\$25 = 2500\text{¢}; 2500\text{¢} \div 25\text{¢} = 100, \text{ Ans.}$$

NOTE. — When the divisor is a *concrete* number, *i.e.* a number associated with objects, the dividend must be a like concrete number; in which case the quotient will be an *abstract* number, *i.e.* a mere number.

3 dollars, 4 coats, 7 apples, are concrete numbers; 3, 4, 7, are abstract numbers.

When the divisor is *abstract* and the dividend *concrete*, the quotient is *concrete*.

## 71. Give answers at sight:

- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 1. $\$4 \div 10\text{¢}$             | 11. $\$1 \div \frac{1}{2}\text{¢}$    |
| 2. $\$5 \div 5\text{¢}$              | 12. $\$3 \div \$\frac{1}{4}$          |
| 3. $\$12 \div 4\text{¢}$             | 13. $\$84 \div 50\text{¢}$            |
| 4. $\$36 \div 6\text{¢}$             | 14. $\$1 \div 16\frac{2}{3}\text{¢}$  |
| 5. $\$63 \div 3\text{¢}$             | 15. $\$16 \div 16\text{¢}$            |
| 6. $\$7 \div 25\text{¢}$             | 16. $\$16 \div 16\frac{2}{3}\text{¢}$ |
| 7. $\$20 \div 33\frac{1}{3}\text{¢}$ | 17. $\$16 \div 33\frac{1}{3}\text{¢}$ |
| 8. $\$36 \div 3\text{¢}$             | 18. $\$16 \div 25\text{¢}$            |
| 9. $\$40 \div 50\text{¢}$            | 19. $\$16 \div 50\text{¢}$            |
| 10. $\$9 \div 10\text{¢}$            | 20. $\$12 \div 20\text{¢}$            |

72. At 36 cents each, how many spellers can be bought for \$ 27 ?

\$ 27 = 2700 cents. Since 1 speller costs 36 cents, the number of spellers that can be bought for 2700 cents will be  $2700 \div 36 = 75$ .

Ans. 75 spellers.

$$\begin{array}{r} 75 \\ 36 \overline{)2700} \\ \underline{252} \\ 180 \\ \underline{180} \end{array}$$

### 73. Written Problems.

1. At \$ 2.75 per day, how long will it take a man to earn \$ 110 ?  
(11,000 + 275.)

2. How many yards of muslin, at 12 cents per yard, can be bought for \$ 126 ?

3. A farmer spent \$ 140 for sheep at \$ 5.60 each. How many did he buy ?

4. A grocer pays \$ 74.50 for tea at  $\frac{1}{2}$  of a dollar per pound. What is the weight of the tea ?

5. When rye is worth 87 cents per bushel, how many bushels can be purchased for \$ 261 ?

6. At  $12\frac{1}{2}$  cents per pound, how many pounds of meat will cost \$ 175.25 ?

7. If 75 spellers cost \$ 27, what is the price of 1 speller ?

If 75 spellers cost \$ 27, 1 speller will cost  $\frac{1}{75}$  of \$ 27.

$$75) \$27.00$$

The divisor 75 is an abstract number. The dividend being a concrete number, the quotient will be *concrete*, viz. \$ .36.

8. A woman paid \$ 24 for 36 yards of dress goods. What did she pay per yard ?

9. At 6 for a dollar, how many rabbits can be bought for \$ 87 ?

10. The cost of 13 houses was \$ 36,887.50. What was the price of each ?

FRACTIONAL PARTS OF A DOLLAR.

SHORT METHODS.

74. What will be the cost of 16 base-balls at 25 cents each?

At  $\$ \frac{1}{4}$  each, 16 base-balls cost 16 quarter-dollars, or  $\$4$ .

75. Oral Exercises.

At 25 cents per pound, yard, dozen, etc., what will be paid for:

- |                        |                            |
|------------------------|----------------------------|
| 1. 32 base-balls ?     | 7. 37 dozen lemons ?       |
| 2. 52 pounds coffee ?  | 8. 25 bushels tomatoes ?   |
| 3. 48 straw hats ?     | 9. 41 panes of glass ?     |
| 4. 84 yards ribbon ?   | 10. 33 packages of candy ? |
| 5. 36 second readers ? | 11. 49 Roman candles ?     |
| 6. 56 vases ?          | 12. 60 bars of soap ?      |

76. At 50 cents, give the cost of:

- |                          |                         |
|--------------------------|-------------------------|
| 1. 46 pounds tea.        | 7. 76 grammars.         |
| 2. 28 pairs of scissors. | 8. 57 boxes of pens.    |
| 3. 38 penknives.         | 9. 49 picture books.    |
| 4. 84 third readers.     | 10. 83 dolls.           |
| 5. 44 pounds candy.      | 11. 27 games.           |
| 6. 32 caps.              | 12. 75 feather dusters. |

77. How many cents in one-eighth of a dollar?

At one-eighth of a dollar each, what will be the cost of 24 bars soap?

At  $\$ \frac{1}{8}$  each, 24 bars cost  $\$ \frac{24}{8}$ , or  $\$3$ .



Give the cost of the following at  $12\frac{1}{2}$  cents per pound, etc. ( $\$ \frac{1}{8}$ ):

- |                    |                               |
|--------------------|-------------------------------|
| 1. 16 pounds meat. | 5. 80 jars of jelly.          |
| 2. 48 dozen eggs.  | 6. 96 cans of condensed milk. |
| 3. 72 straw hats.  | 7. 104 yards sheeting.        |
| 4. 64 gallons oil. | 8. 88 pounds currants.        |

78. How many cents in one-third of a dollar?

At one-third of a dollar each, what will be the cost of 12 bottles of cologne?

At  $\$ \frac{1}{3}$  each, 12 bottles cost  $\$ 1\frac{2}{3}$ , or  $\$ 4$ .

Give the cost, at  $33\frac{1}{3}$  cents per yard, pound, etc., of:

- |                         |                         |
|-------------------------|-------------------------|
| 1. 36 yards of ribbon.  | 4. 27 bushels of oats.  |
| 2. 63 pairs of cuffs.   | 5. 54 pecks of walnuts. |
| 3. 48 pounds of butter. | 6. 72 dozen oranges.    |

79. How many cents in three-fourths of a dollar?

If sleds cost  $\$ \frac{3}{4}$  each, what is paid for 16 sleds?

At  $\$ \frac{3}{4}$  each, 16 sleds would cost  $\$ 1\frac{1}{2}$ , or  $\$ 4$ ; at  $\$ \frac{1}{2}$  each, the cost is 3 times  $\$ 4$ , or  $\$ 12$ .

Give the cost of the following at 75 cents per yard, etc.:

- |                        |                        |
|------------------------|------------------------|
| 1. 48 yards silk.      | 4. 28 gallons syrup.   |
| 2. 24 bushels peaches. | 5. 36 base-balls.      |
| 3. 84 pounds tea.      | 6. 32 concert tickets. |

80. Find the cost of 13 pairs of gloves at 75 cents per pair.

Since 13 is not exactly divisible by 4, this problem should be handled as follows:

13 pairs at  $\$ \frac{3}{4}$  per pair cost  $\$ 9\frac{3}{4}$ , or  $\$ 9\frac{3}{4}$ , or  $\$ 9.75$ .

Give the cost of the following at 75 cents per bushel, etc.:

- |                          |                         |
|--------------------------|-------------------------|
| 1. 11 bushels rye.       | 4. 7 mats.              |
| 2. 15 gallons ice-cream. | 5. 21 bushels potatoes. |
| 3. 9 cloth caps.         | 6. 18 pairs of skates.  |

are these parts of a dollar more important than a nickel, quarter or half dollar, which are not to be found by themselves in any rational table of fractional money?

# 81. Parts of a Dollar.

$$6\frac{1}{2} \text{ cents} = \frac{1}{8} \text{ of } \$1$$

$$8\frac{1}{2} \text{ cents} = \frac{1}{8} \text{ of } \$1$$

$$12\frac{1}{2} \text{ cents} = \frac{1}{8} \text{ of } \$1$$

$$16\frac{1}{2} \text{ cents} = \frac{1}{8} \text{ of } \$1$$

$$25 \text{ cents} = \frac{1}{4} \text{ of } \$1$$

$$33\frac{1}{2} \text{ cents} = \frac{1}{3} \text{ of } \$1$$

$$37\frac{1}{2} \text{ cents} = \frac{3}{8} \text{ of } \$1$$

$$50 \text{ cents} = \frac{1}{2} \text{ of } \$1$$

$$62\frac{1}{2} \text{ cents} = \frac{5}{8} \text{ of } \$1$$

$$66\frac{1}{2} \text{ cents} = \frac{3}{4} \text{ of } \$1$$

$$75 \text{ cents} = \frac{3}{4} \text{ of } \$1$$

$$87\frac{1}{2} \text{ cents} = \frac{7}{8} \text{ of } \$1$$

# 82. Oral Exercises.

Give the cost of 72 articles at:

1.  $12\frac{1}{2}$  cents each.

4. 25 cents each.

2.  $33\frac{1}{2}$  cents each.

5. 50 cents each.

3.  $16\frac{1}{2}$  cents each.

6.  $37\frac{1}{2}$  cents each.

$87\frac{1}{2}$  cents =  $\frac{7}{8}$ . At  $\frac{7}{8}$  each, the cost of 72 articles would be \$9; at  $\frac{3}{4}$ , \$27.

7.  $62\frac{1}{2}$  cents each.

9.  $66\frac{1}{2}$  cents each.

8.  $87\frac{1}{2}$  cents each.

10. 75 cents each.

# 83. Multiply:

1.  $6\frac{1}{2}$  cents  $\times$  16

10.  $66\frac{1}{2}$  cents  $\times$  33

2.  $8\frac{1}{2}$  cents  $\times$  24

11. 75 cents  $\times$  128

3.  $12\frac{1}{2}$  cents  $\times$  88

12.  $87\frac{1}{2}$  cents  $\times$  88

4.  $16\frac{1}{2}$  cents  $\times$  54

13.  $\$1.33\frac{1}{3} \times 24$

5. 25 cents  $\times$  240

14.  $\$1.12\frac{1}{2} \times 16$

6.  $33\frac{1}{2}$  cents  $\times$  66

15.  $\$2.25 \times 12$

7. 50 cents  $\times$  186

16.  $\$3.75 \times 12$

8.  $37\frac{1}{2}$  cents  $\times$  48

17.  $\$4.37\frac{1}{2} \times 8$

9.  $62\frac{1}{2}$  cents  $\times$  32

18.  $\$5.16\frac{2}{3} \times 6$

**84. Find the cost of:**

1. 86 neckties, at 50 cents each.
2. Six dozen handkerchiefs, at 25 cents apiece.
3. 32 yards of silk, at  $\$1.12\frac{1}{2}$  per yard ( $\$1\frac{1}{4}$ ).
4. 64 arithmetics, at 75 cents each.
5. 84 geographies, at  $\$1.25$  each ( $\$1\frac{1}{4}$ ).
6. 96 pounds of tea, at 75 cents a pound.
7. 84 pairs of gloves, at  $\$1.50$  per pair.
8. 72 yards of cloth, at  $\$2.12\frac{1}{2}$  per yard.

**85. Written Exercises.**

NOTE. — Pupils should be taught to perform operations without placing the numbers under each other. In working examples 1 to 8, one figure is written at a time, beginning at the right. The answers to examples 9 to 12 are found by division, one figure being written at a time. In examples 13 to 20, the cents should be changed to fractions of a dollar.

Write answers.

- |                                     |                                           |
|-------------------------------------|-------------------------------------------|
| 1. 687 pounds, at 4¢.               | 11. 933 yards, at $33\frac{1}{4}$ ¢.      |
| 2. 976 yards, at 6¢.                | 12. 2504 dolls, at 25¢.                   |
| 3. 938 coats, at \$7.               | 13. 248 pounds, at 75¢.                   |
| 4. 695 pounds, at 20¢.              | 14. 186 pounds, at $66\frac{2}{3}$ ¢.     |
| 5. 12 bushels, at \$1.43.           | 15. 8 barrels, at \$16.37 $\frac{1}{2}$ . |
| 6. 11 sheep, at \$7.47.             | 16. 16 gallons, at \$3.62 $\frac{1}{2}$ . |
| 7. 9 tons, at \$22.75.              | 17. 124 bushels, at \$1.50.               |
| 8. 13 sacks of salt, at \$1.11.     | 18. 96 pounds, at \$1.25.                 |
| 9. 352 yards, at $12\frac{1}{2}$ ¢. | 19. 120 gallons at \$2.33 $\frac{1}{4}$ . |
| 10. 1728 hats, at 50¢.              | 20. 64 sacks, at \$1.12 $\frac{1}{2}$ .   |

## 86. Oral Exercises.

At 50 cents each, how many penknives can be bought for \$1? For \$2? For \$3? For \$10? For \$20?

At 25 cents each, how many readers can be bought for \$1? For \$2? For \$3? For \$10? For \$20?

At  $12\frac{1}{2}$  cents per yard, how many yards can be bought for \$1? For \$2? For \$3? For \$10? For \$20?

At  $33\frac{1}{2}$  cents per pound, how many pounds can be bought for \$1? For \$2? For \$3? For \$10? For \$20?

## 87. At 25 cents each (four for \$1):

1. How many base-balls can be bought for \$9?
2. Straw hats, for \$12?
3. Roman candles, for \$18?
4. Readers, for \$15?
5. Vases, for \$21?
6. Bars of soap, for  $\$3\frac{1}{4}$ ?
7. Packages of candy, for  $\$4\frac{1}{2}$ ?
8. Yards of ribbon, for \$5.75?
9. Bushels of tomatoes, for \$10.50?
10. Pounds of coffee, for \$12.75?

## 88. At 50 cents (two for \$1):

11. Pounds of tea, for \$43?
12. Penknives, for \$20.50?
13. Pounds of candy, for \$94?
14. Third readers, for \$17.50?
15. Caps, for \$21?
16. Grammars, for \$37?

17. Boxes of pens, for \$72?
  18. Dolls, for \$64?
  19. Pairs of scissors, for \$19?
  20. Feather dusters, for \$26.50?
89. At  $12\frac{1}{4}$  cents (eight for \$1) :
21. Gallons of oil, for \$8?
  22. Dozen of eggs, for \$11?
  23. Pounds of meat, for \$21?
  24. Quarts of plums, for  $\$1\frac{1}{4}$ ?
  25. Jars of jelly, for  $\$1\frac{1}{4}$ ?
  26. Yards of sheeting, for  $\$1\frac{1}{4}$ ?
  27. Cans of milk, for  $\$2\frac{1}{4}$ ?
  28. Pounds of currants, for  $\$3.12\frac{1}{4}$ ?
  29. Whisk brooms, for  $\$4.37\frac{1}{4}$ ?
  30. Collars, for  $\$5.62\frac{1}{4}$ ?
90. At  $33\frac{1}{3}$  cents (three for \$1) :
31. Yards of ribbon, for \$6?
  32. Pairs of cuffs, for \$12?
  33. Pounds of butter, for \$18?
  34. Bushels of oats, for \$32?
  35. Pecks of walnuts, for  $\$1\frac{1}{3}$ ?
  36. Dozen of oranges, for  $\$1\frac{1}{3}$ ?
  37. Straw hats, for  $\$2.33\frac{1}{3}$ ?
  38. Dolls, for  $\$3.66\frac{2}{3}$ ?
  39. Penknives, for  $\$4.33\frac{1}{3}$ ?
  40. Pounds of candy, for  $\$5.66\frac{2}{3}$ ?

91. At  $16\frac{3}{4}$  cents (six for \$1):

- |                                           |                                        |
|-------------------------------------------|----------------------------------------|
| 41. Collars, for \$4?                     | 46. Quarts, for \$1.16 $\frac{3}{4}$ ? |
| 42. Pounds, for \$21?                     | 47. Gallons, for \$1.50?               |
| 43. Yards, for \$ $\frac{1}{2}$ ?         | 48. Pecks, for \$2 $\frac{3}{4}$ ?     |
| 44. Ounces, for \$ $\frac{1}{2}$ ?        | 49. Feet, for \$3.33 $\frac{1}{3}$ ?   |
| 45. Packages, for 66 $\frac{2}{3}$ cents? | 50. Yards, for \$4.66 $\frac{2}{3}$ ?  |

92. Oral Exercises.

Divide at sight:

- |                                        |                                                      |
|----------------------------------------|------------------------------------------------------|
| 51. \$24.50 by 50 cents.               | 56. \$18.75 by 25 cents.                             |
| 52. \$12.25 by 25 cents.               | 57. \$11.87 $\frac{1}{2}$ by 12 $\frac{1}{2}$ cents. |
| 53. \$26 by 33 $\frac{1}{3}$ cents.    | 58. \$13.33 $\frac{1}{3}$ by 33 $\frac{1}{3}$ cents. |
| 54. \$14.50 by 12 $\frac{1}{2}$ cents. | 59. \$37.50 by 50 cents.                             |
| 55. \$17 by 16 $\frac{2}{3}$ cents.    | 60. \$13.33 $\frac{1}{3}$ by 16 $\frac{2}{3}$ cents. |

*Table of U. S. money omitted.*

### DENOMINATE NUMBERS.

93. Learn the following tables:

#### TIME.

60 seconds (sec.)	= 1 minute (min.)
60 minutes	= 1 hour (hr.)
24 hours	= 1 day (da.)
7 days	= 1 week (wk.)

#### AVOIRDUPOIS WEIGHT.

16 ounces (oz.)	= 1 pound (lb.)
2000 pounds	= 1 ton (T.)

The hundredweight (100 pounds) is written cwt.

#### DRY MEASURE.

2 pints (pt.)	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)

## Chapter One.

## LIQUID MEASURE.

2 pints (pt.)	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)

A gill (gi.) is equal to one-fourth of a pint. It is very rarely used.

## LINEAR MEASURE.

12 inches (in.)	= 1 foot (ft.)
3 feet	= 1 yard (yd.)
$5\frac{1}{2}$ yards	= 1 rod (rd.)
320 rods	= 1 mile (mi.)

$$1 \text{ mi.} = 320 \text{ rd.} = 1760 \text{ yd.} = 5280 \text{ ft.} = 63,360 \text{ in.}$$

A furlong is equal to 40 rods,  $\frac{1}{8}$  mile.

A *hand*, used in measuring the height of horses, = 4 in. A *knot*, used in measuring distances at sea, = 1.15 mi. A *fathom*, used in measuring the depth of the sea, = 6 ft.

## SQUARE MEASURE.

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre (A.)
640 acres	= 1 square mile (sq. mi.)

$$1 \text{ A.} = 160 \text{ sq. rd.} = 4840 \text{ sq. yd.} = 43,560 \text{ sq. ft.}$$

A *section* of land is a mile square.

Roofing, flooring, and slating are often estimated by the *square*, which contains 100 square feet.

## 94. Written Exercises.

1. How many hours in  $7\frac{1}{2}$  days?
2. How many hours in 7 days 12 hours?
3. How many minutes in 2 hours? How many seconds?
4. A man buys 12 bushels and 3 pecks apples at \$1 per bushel. What is the cost?

5. What will be the cost of 3 pecks 7 quarts chestnuts at 8 cents per quart?

6. How many pints are there in 5 gallons of ice-cream?

7. How many half-pints are there in 10 gallons of ice-cream?

8. How many 4-ounce packages can be made from 5 pounds of pepper?

9. A boy pays \$1.50 for 1 gallon and 2 quarts of ice-cream. What is the price per quart?

10. How many gallons of lemonade will be needed to give 96 people  $\frac{1}{2}$  pint each?

11. How many seconds in 5 hours?

12. How many hours in 1 week?

13. Change 13 hours and 20 minutes to minutes.

14. Change 15 bushels 4 pecks to pecks.

15. How many ounces in 47 pounds 5 ounces?

16. How many pounds and ounces in 237 ounces?

17. Change 1494 minutes to hours and minutes.

18. Find the number of hours in 6 weeks.

19. Change 60 pounds to the decimal of a hundredweight.

20. How many inches are there in 12 feet 2 inches?

21. How many pounds in  $14\frac{1}{4}$  tons?

22. How many pounds in  $\frac{3}{8}$  of a ton?

23. What will 400 pounds of coal cost at \$5 per ton?

24. What decimal of a ton is 1500 pounds?

25. How many days and hours in  $\frac{1}{8}$  of a week?

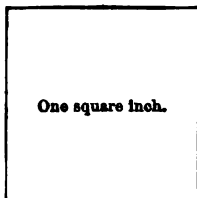
26. Find the number of yards in 3 pieces of cloth, each containing 16 yards 2 feet.

27. When coal is \$7.50 per ton, what will be the cost of 3000 pounds?



**MEASUREMENTS.****95. Preliminary Exercises.**

Draw a square each side of which is one inch. This is called a square inch. Cut out of paper several one-inch squares.



Draw a rectangle two inches long, one inch wide. How many paper one-inch squares will exactly cover it?

Draw a rectangle three inches long, two inches wide. Divide it into one-inch squares. How many one-inch squares are there in the lower row? How many rows? How many square inches in the rectangle?

How many square inches in a rectangle 6 inches long, 3 inches wide?

How many square inches in a rectangle 4 inches long, 4 inches wide?

How many square inches are there in a rectangle 12 inches long, 3 inches wide? In a rectangle 1 foot long, 3 inches wide? In a rectangle 1 foot 1 inch long, 4 inches wide?

**NOTE.** — The foregoing exercises should be accompanied by accurate drawings on paper or on the blackboard, which should lead the pupils to see that the unit in the given examples is the *square inch*. They should be made aware that the number of squares in the lower row corresponds to the length of the rectangle in inches; and that the number of rows corresponds to the width of the rectangle. From this they should deduce the rule :

*The number of square inches in the surface of a rectangle is equal to the number of inches in its length taken as many times as there are inches in its width.*

This product is called the *area* of the rectangle.

96. The area of a surface is the number of times that it contains another surface, taken as the unit of measurement. Thus, the statement that the area of a surface is 8 square inches means that a square inch is contained in the surface 8 times.

97. The sum of all the sides of a figure is called its perimeter.

### 98. Written Exercises.

Find the area of each of the following rectangles in square inches. Find the perimeter of each in feet and inches.

- |                     |                           |
|---------------------|---------------------------|
| 1. 13 in. by 14 in. | 7. 13 in. by 42 in.       |
| 2. 17 in. by 9 in.  | 8. 27 in. by 31 in.       |
| 3. 18 in. by 7 in.  | 9. 18 in. by 22 in.       |
| 4. 23 in. by 15 in. | 10. 64 in. by 29 in.      |
| 5. 21 in. by 19 in. | 11. 1 ft. by 7 in.        |
| 6. 37 in. by 14 in. | 12. 1 ft. 1 in. by 11 in. |

NOTE. — Change each dimension to inches before multiplying.

- |                           |                                 |
|---------------------------|---------------------------------|
| 13. 1 ft. 3 in. by 12 in. | 17. 2 ft. 6 in. by 1 ft. 3 in.  |
| 14. 1 ft. by 1 ft.        | 18. 3 ft. 7 in. by 2 ft. 9 in.  |
| 15. 1 ft. 4 in. by 1 ft.  | 19. 4 ft. 11 in. by 1 ft. 8 in. |
| 16. 2 ft. 6 in. by 1 ft.  | 20. 5 ft. 3 in. by 2 ft. 11 in. |

### 99. Oral Exercises.

How many square feet in a rectangle 2 feet long, 1 foot wide?

How many square feet in a rectangle 6 feet long by 5 feet wide?

How many square feet in a rectangle 9 feet long by 7 feet wide?

NOTE. — The unit in the following examples is the *square foot*.

**100. Written Exercises.**

Find the area in square feet of each of the following rectangles. Find the perimeter of each in feet.

- |                     |                                  |
|---------------------|----------------------------------|
| 1. 12 ft. by 14 ft. | 6. 29 ft. by 12 ft.              |
| 2. 15 ft. by 17 ft. | 7. $15\frac{1}{2}$ ft. by 12 ft. |
| 3. 19 ft. by 11 ft. | 8. 15 ft. 6 in. by 12 ft.        |
| 4. 23 ft. by 15 ft. | 9. $18\frac{1}{2}$ ft. by 16 ft. |
| 5. 18 ft. by 16 ft. | 10. 18 ft. 9 in. by 16 ft.       |

NOTE. — Change the inches to fractions of a foot.

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| 11. $23\frac{1}{2}$ ft. by 18 ft. | 16. 36 ft. by 23 ft. 5 in.        |
| 12. 24 ft. 8 in. by 18 ft.        | 17. 13 ft. by $24\frac{1}{2}$ ft. |
| 13. 19 ft. 3 in. by 16 ft.        | 18. 13 ft. 4 in. by 24 ft.        |
| 14. 24 ft. by 17 ft. 9 in.        | 19. 26 ft. 8 in. by 15 ft.        |
| 15. 24 ft. by 16 ft. 1 in.        | 20. $12\frac{1}{2}$ ft. by 12 ft. |

**101. Suggestive Examples.**

1. Measure the top of the desk, disregarding fractions of an inch, and calculate the surface in square inches.

2. Measure the blackboard, and find how many square feet in its surface. (Do not include fractions of a foot.)

3. Calculate the number of square inches in a pane of glass in the schoolroom window.

4. Find the number of square feet in the floor of the classroom.

5. Find the number of square feet in the classroom ceiling.

6. Estimate the height of the classroom, and calculate the number of square feet in the front wall. 7. In the rear wall. 8. In the right-hand wall. 9. In the left-hand wall.

102. Written Problems.

SUGGESTION.—When the surface is required in square inches, change each dimension to inches; when required in square feet, express each dimension in feet, or in feet and the fraction of a foot; when required in square yards, etc., express each dimension in yards, etc.

1. How many square feet are there in the surface of a field 125 feet long, 87.5 feet wide?

$$(1 \text{ square foot} \times 125 \times 87.5.)$$

2. A rug is 2 yards long,  $1\frac{1}{2}$  yards wide. How many square yards does it contain?

$$(1 \text{ square yard} \times 2 \times 1\frac{1}{2}.)$$

3. How many square yards are there in a strip of carpet 6 yards long, 27 inches ( $\frac{3}{4}$  yard) wide?

4. Find the number of square meters in a room 12 meters long, 9.75 meters wide.

5. At 50 cents per square yard, what will be the cost of the oil-cloth needed to cover a floor 18 feet (6 yards) long, 15 feet (5 yards) wide?

6. What will be the cost, at \$1.50 per square yard, of carpeting a room  $6\frac{1}{2}$  yards long, 15 feet wide?

7. At 3 cents a square foot, how much must be paid for 10 boards, each 16 feet long,  $\frac{1}{2}$  foot wide?

8. A field is 30 rods long and 24 rods wide. How many square rods will it contain after a strip 24 rods long and 2 rods wide is taken from it for a road?

9. How many square yards of plastering will be required for a ceiling 18 feet long, 15 feet wide?

10. If a roll of wall paper is 24 feet long and 18 inches wide, how many square yards does it contain?

## BILLS.

103.

CHICAGO, July 31, 1904.

MRS. M. O'DONNELL.

*Bought of SEAVER BROTHERS.*

<i>1<math>\frac{1}{4}</math> yd. Plaid</i>	<i>\$ 1.00</i>			
<i>16 yd. Cambric</i>	<i>.05</i>			
<i>12 pr. Socks</i>	<i>.25</i>			
<i>1 Wrapper</i>		<i>1</i>	<i>98</i>	
<i>4 yd. Silk</i>	<i>.65</i>			
<i>1 pr. Gloves</i>		<i>2</i>	<i>25</i>	
<i>2 spools Silk</i>	<i>.08</i>			
				<i>\$</i>

1. Copy the above, filling in the cost of each item and the total.

In these examples, the total cost of each item should be written in its place without any side calculation. Pupils should be drilled in short, direct methods of computation, being required to omit unnecessary figures.

In No. 2, for instance, 64 is multiplied by  $5\frac{1}{4}$ , as follows:

$\frac{1}{4}$  of 64 is 16; carry this to the product of 5 and 4, making 32; write 8. 5 times 6 are 30, add 2, making 32. Total, 328.

2. Otto Haas buys of Murphy & Cooper 64 pounds of sugar @  $5\frac{1}{8}\phi$ ; 28 pounds of lard @  $9\frac{1}{4}\phi$ ; 24 pounds of coffee @  $25\phi$ ; 1 barrel flour @ \$5.75; and 12 gallons of molasses @  $25\frac{1}{2}\phi$ . Make out the bill.

3. Make out a bill for 10 pairs of men's shoes, at \$4.75; 4 pairs of boys' shoes, at \$1.47 $\frac{1}{2}$ ; 6 pairs slippers, at \$.87 $\frac{1}{2}$ ; 9 pairs of girls' shoes, at \$2.43; 8 pairs of women's shoes, at \$3.37 $\frac{1}{2}$ .

4. Make out a bill for  $8\frac{1}{2}$  pounds of ham, at 14¢ per pound;  $3\frac{1}{2}$  pounds of beefsteak, at 20¢; 9 pounds of corned beef, at 12¢;  $10\frac{1}{4}$  pounds of chicken, at 24¢; 12 pounds of roast beef, at 18¢.

5. Make out a bill for 14 dozen collars, at \$1.50 per dozen; 6 dozen pairs of cuffs, at \$2.75 per dozen pairs; 4 dozen shirts, at \$9 per dozen; 3 dozen ties, at \$2.25 per dozen; 17 dozen pairs of socks, at \$2.10 per dozen pairs.

#### 104. Review Exercises. Approximate Answers.

NOTE. — These drills are intended to lead a pupil to such an examination of his answers to other problems as will prevent him from being satisfied with one that is very far astray.

It is not expected that every pupil will give exactly the same answer. In No. 5, for instance, the cost of 99 yards is asked at \$1.95 per yard. One pupil may consider 100 yards at \$2, or \$200; a second may keep the rate at \$1.95, and say \$195; a third might come still closer; each of such answers, however, should be accepted as an approximation.

1. What will be the cost of  $39\frac{7}{8}$  pounds butter at 20¢ per pound?

Nearly 40 pounds at 20¢. The cost is nearly what? Solve.

2. A man has 4200 pounds of flour which he wishes to put into barrels containing 196 pounds each. About how many barrels will he need?

Each barrel contains nearly how many pounds? Solve.

3. A merchant bought a hogshead of molasses, containing  $47\frac{3}{4}$  gallons, at 50 cents per gallon. About how much did it cost?

4. How many lots at \$1975 each can be bought for \$12,000?

5. Sold 3 pieces of cloth, 33 yards to the piece, at \$1.95 per yard. Give the approximate amount of the bill.

6.  $28\frac{1}{8} + 37\frac{1}{8} =$  nearly what?
7.  $175\frac{1}{8} + 24\frac{2}{10} =$  nearly what?
8.  $18\frac{1}{8} \times 9\frac{1}{8} =$  nearly what?
9.  $87\frac{1}{8} - 49\frac{1}{8} =$  nearly what?
10.  $4\frac{1}{8} \times 4\frac{1}{8} \times 4\frac{2}{10} =$  nearly what?

### 105. Oral Review Problems.

1. What will be the cost of 8 pounds of meat at 15 cents per pound?
2. Gave \$1 in payment for a 25-cent ball, and four 10-cent bats. How much change did I receive?
3. At the rate of 3 oranges for 5 cents, what will be the cost of a dozen oranges?
4. A gross is 12 dozen. How many pens in  $\frac{1}{2}$  gross?
5. How many inches in 4 yards?
6. At 5 cents per pint, how much would be paid for a bushel of chestnuts?
7. A person used 2 gallons and 3 quarts of milk one week, and 3 gallons and 1 quart the next week. How many gallons are used in the two weeks?
8. Multiply 15 by 5. Take 18 from the product.
9. How many 9's in 3 times 21?
10. 12 times 6 are how many times 8?
11. To 9 times 7 add 10. Take 15 from the sum.
12. One can has in it 4 gallons of milk, and another has in it 6 quarts. How many pints are in both?
13.  $27 + 15 + 18 + 25 + 9 = ?$
14. James had half a dollar to spend; he bought 14 cents' worth of candy, and spent the rest of his money for oranges at 4 cents each. How many oranges did he buy?

15. A woman bought 7 pounds of rice at 12¢ a pound, and paid for it with a dollar bill. How much money did she receive in change?

16. A man paid one dollar for a bag of peanuts containing 3 pecks. He sold them at \$0.10 a quart. How much did he gain?

17. Book, 75¢; pencil, 8¢; slate, 15¢ = ?

18. 20 boxes of berries at 15¢ = ?

19. At 6 cents each, how many bananas for \$1? How many cents over?

20. Bought 3 pounds of raisins worth 12 cents a pound; 2 dozen bananas at 25 cents a dozen. I gave the man a dollar bill. How much did he give back?

21. How many hours are there in a week?

22. If John earned 16¢ Monday, 9¢ Tuesday, 20¢ Wednesday, 15¢ Thursday, 8¢ Friday, and 12¢ Saturday, how much did he earn in the whole week?

23. What will 3 bushels of sand cost, at 4¢ a peck?

24. Mrs. Hall divided 84 oranges equally among 14 girls. How many oranges did each girl receive?

25. If you give 24 cents for one thing, and 19 cents for another, what will both things cost?

26. If a quart of milk is worth 7¢, what is the value of two gallons?

27. Find the cost of 60 oranges at 20 cents per dozen.

#### 106. Written Review Problems.

1. A man walks  $14\frac{1}{2}$  miles in  $4\frac{1}{2}$  hours. How many miles an hour is that?

2. If a milk can holds 23 quarts and 1 pint, how many half-pints does it hold?



3. Bought 87 pounds of tea at 45 cents a pound; sold it at 63 cents a pound. How much was gained?

4. In a school there were 356 girls and 259 boys; if 25 girls and 32 boys leave, how many pupils remain in the school?

5. Which are worth more, 63 cows at \$ 38 apiece, or 56 horses at \$ 75 apiece? How much more?

6. Suppose your mother gave you a 5-dollar bill to buy articles for the Sunday dinner, and you bought 6 lb. of roast beef at 25 cents a lb., 1 pk. spinach at 45 cents, 2 qt. of onions at  $12\frac{1}{2}$  cents, 1 doz. oranges at 12 cents, 2 qt. of milk at 7 cents. How much change would you bring home to your mother?

7. If a railway mail clerk earns \$ 800 in a year, how much will he have left after paying his board at the rate of \$ 16 a month?

8. How many pieces of second-class matter (newspapers) are there in 644 pounds, each piece weighing 8 ounces?

9. The postmaster at Norwich made requisition for the following postage stamps: 27 sheets of 1-cent, 97 sheets of 2-cent, 35 sheets of 5-cent, and 17 sheets of 10-cent stamps. What was the money value of these stamps, there being 100 stamps in each sheet?

10. The whole number of pieces of mail matter handled at 212 post-offices was 2,164,517,880. What was the average number of pieces for each office?

11. A merchant pays \$ 30 for 65 vases. He sells 17 of them at 50 cents each, and receives 48 cents each for the others. What is his profit?

12. One boy had 15 marbles, another had 19, a third had 17, a fourth had 13. What was the average number of marbles for each boy?

13. A teacher divided 200 foreign postage stamps among the eight boys of his class. He gave one-fourth of them to the first boy, one-fifth of the remainder to the second boy, and then divided the rest equally among the other six boys. How many did each of the latter receive?

14. If 23 buggies cost \$4025, what are 80 buggies worth?

15. How many gills in 7 quarts and 1 pint?

16. How many bushels in 384 quarts?

17. Change 864 pints to gallons.

18. A farmer exchanged 16 cows, worth \$40 each, for a span of horses. What are the horses worth apiece?

19. A boy bought a bicycle for \$35. He rented it to another boy for 3 months at \$2 a month, and then sold it for \$33.50. Did he gain or lose, and how much?

20. John had 16 marbles, Henry half as many, and Frank as many as both the other boys. How many more marbles had Frank than John?

21. How many quarts in 12 bushels?

22. How many feet of string will be required to go around a room 30 feet long and 25 feet wide?

23. If I buy a bushel of walnuts for \$3, and sell them at 5 cents a pint, how much do I make?

24. Write 83, 47, 69, and 56 in Roman numbers.

25. A man works 9 months, 26 days per month, and receives \$702. What are his daily wages?

26. A merchant buys 136 vases for \$272. If 36 are broken, how much must he charge apiece for the others to gain \$28 on all?

*Antiquated type of foreign  
problems  
Comparison with  
any of  
the  
problems  
on p. 132  
Smith Adv.*

27. On Monday, the receipts of a store are \$180; on Tuesday, \$30 less; on Wednesday, \$110 less than the total of Monday and Tuesday. What are the receipts for the three days?

28. The yearly rent of a house is \$480. What is the rent for 2 years 4 months?

29. A mechanic works 300 days per year, at \$4 per day. If his daily expenses for 365 days average \$3, how much money does he save each year?

30. A woman pays \$5.20 for 3 pounds of tea and 56 pounds of sugar. What is the price per pound of the sugar, if the tea costs 80¢ per pound?

31. A man had \$7500. He paid  $\frac{1}{3}$  of it for a house, \$575.60 for repairs, and \$387.75 for furniture. How much money had he left?

32. How much hay will be required to feed 18 horses a month of 30 days, if each horse receives 15 pounds a day?

33. A person pays a debt of \$576, giving 40 ten-dollar bills, 30 two-dollar bills, 6 one-dollar bills, and the remainder in five-dollar bills. How many of the last did he give?

34. A drover buys 64 sheep for \$400. He sells  $\frac{1}{2}$  of them at \$7 each, and the remainder at \$8 each. What is his profit?

35. A merchant sells 56 yards of cloth for \$84, gaining \$14. What did it cost him per yard?

36. A package of coffee, costing 60 cents, was sold for 75 cents, the profit on each pound being 5 cents. What was the selling price per pound?

37. How many yards of cloth, at \$1.75 per yard, can be bought for \$105?

38. A tailor buys a piece of cloth for \$50. From it he makes 4 pairs of trousers, which he sells at \$7 per pair, and 4 coats, for each of which he receives \$15. Thread, buttons, lining, etc., cost him \$16. How much does he get for his labor?

39. A man sold a certain number of papers for 50 cents. If he had sold nine more, he would have received 95 cents. How many papers did he sell?

40. How long is a post which is  $5\frac{1}{2}$  feet above water, one-half of its length in the water, and one-fourth of its length in the mud? (Make a diagram.)

1795  
a.p.

41. Eight pounds of black tea costing 35¢ per pound are mixed with twelve pounds of green tea costing 50¢ per pound. What is the cost of 20 pounds of the mixed tea?

42. How many bushels and pecks are there in 1442 pounds of corn weighing 56 pounds per bushel?

43. How is division proved?

44. Multiply by 208 the quotient of  $(169,668 \div 36)$ .

45. Add seventy-two dollars, eleven cents; fifteen dollars, nine cents; eighty-seven cents; three hundred fifty dollars; and one dollar, four cents.

46. Which is greater and how much?

$$486 \times 29 \text{ or } 26,845 - 19,976.$$

47. Write in Roman numerals 1905, 1775, and 560.

48. If a railway mail clerk spends ten cents a day for street-car fare, how much will he spend in six months of 30 days each?

49. Add nine thousand eleven, seventy thousand forty-four, five hundred thousand four hundred ten, fifty-four thousand twenty-one.

50. Multiply \$40.25 by 96.

51. From \$300,000 take \$7050.75.

52. How many days will 36 bushels of oats last 12 horses, if each horse eats 12 quarts a day?

53. If a barrel of flour is worth \$4.50, how many barrels can be bought for \$441? How much will all the flour weigh if each barrel holds 196 pounds?

54. Suppose your slate is 12 inches long, 9 inches wide, and 15 inches across diagonally. How long a string is needed to go around the outside and along the diagonal? Make a diagram to explain your work.

55. The total cost of the Union Pacific railroad, which is 1819 miles long, was \$157,092,478. What was the average cost per mile?

56. An officer who was paid \$3.50 a day stayed in the service until he had earned \$143.50. How many days had he worked?

57. A cargo of potatoes was discharged in tubs containing 250 pounds each, which were filled 1785 times. A bushel of potatoes weighs 60 pounds. How many bushels were landed?

58. How long will it take 50 clerks to count \$1,500,000 in silver coin, one-half of which is in half-dollars and the other half in quarter-dollars, each clerk counting at the rate of fifty pieces a minute? Express the answer in hours.

59. Write in figures one million one thousand one dollars and one cent.

60. Multiply 657,934 by 3209.

61. The War Department expended \$1765.25 for mucilage at \$5.75 a dozen quarts. How many quarts were purchased?

*No definition of fractions given.*

## CHAPTER II.

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### FACTORS AND MULTIPLES.

**107.** The *factors* of a number are the integers whose product makes the number.

NOTE. — An integer is any whole number.

2 and 3 are factors of 6.

2, 3, and 5 are factors of 30.

**108.** A number that contains another number an exact number of times is a *multiple* of that number.

24 is a multiple of 12; 36, 48, etc., are also multiples of 12.

30 is a multiple of 2, 3, 5, 6, 10, 15.

*Fractions!*

**109. Preliminary Exercises.**

1. 95 is a multiple of what two numbers?
2. Give the two factors of 51.
3. What number is a multiple of both 8 and 6?
4. Mention another number that is a multiple of both 8 and 6.
5. Find the smallest number that can be exactly divided by 8 and 12.
6. Give the two factors of 91.
7. 57 is a multiple of what two numbers?
8. What is the smallest number that can be exactly divided by 4, 6, and 8?

**PRIME NUMBERS.**

**110. A number that has no factors is a *prime number*.**

NOTE. — 1 is not considered a factor.

1, 2, 3, 5, 7, etc., are prime numbers.

- 111.**
- |                                              |                        |
|----------------------------------------------|------------------------|
| 1. Name the prime numbers between 10 and 20. |                        |
| 2. Between 20 and 30.                        | 4. Between 50 and 70.  |
| 3. Between 30 and 50.                        | 5. Between 70 and 100. |

**112. Oral Exercises.**

Give the prime factors, commencing with the smallest.

- |       |        |        |        |
|-------|--------|--------|--------|
| 1. 15 | 6. 40  | 11. 64 | 16. 80 |
| 2. 16 | 7. 48  | 12. 72 | 17. 81 |
| 3. 24 | 8. 54  | 13. 74 | 18. 82 |
| 4. 32 | 9. 56  | 14. 76 | 19. 84 |
| 5. 36 | 10. 60 | 15. 77 | 20. 85 |

**113. Written Exercises.**

1. Find the prime factors of 180.

Divide 180 by its smallest prime factor, 2. Divide the quotient 90 by its smallest prime factor, 2. Divide 45 by its smallest prime factor, 3. Divide 15 by its smallest prime factor, 3. The quotient 5 is a prime number.

The prime factors of 180 are 2, 2, 3, 3, 5, *Ans.*

$$\begin{array}{r} 2 \overline{)180} \\ 2 \overline{)90} \\ 3 \overline{)45} \\ 3 \overline{)15} \\ 5 \end{array}$$

- |       |        |         |          |
|-------|--------|---------|----------|
| 2. 86 | 7. 92  | 12. 100 | 17. 576  |
| 3. 87 | 8. 93  | 13. 120 | 18. 840  |
| 4. 88 | 9. 94  | 14. 210 | 19. 1152 |
| 5. 90 | 10. 95 | 15. 240 | 20. 1728 |
| 6. 91 | 11. 96 | 16. 360 | 21. 2016 |

**GREATEST COMMON DIVISOR.**

**114. A common factor** of two or more numbers is a number that will divide each of them without remainder.

The largest number that is a factor of two or more numbers is called the *greatest common divisor*.

**115. Oral Exercises.**

Find the greatest common divisor of:

- |              |               |
|--------------|---------------|
| 1. 27 and 48 | 6. 34 and 51  |
| 2. 25 and 35 | 7. 32 and 48  |
| 3. 36 and 54 | 8. 45 and 75  |
| 4. 26 and 39 | 9. 40 and 65  |
| 5. 42 and 63 | 10. 54 and 69 |

*Three pairs in fractions.*



## LOWEST TERMS.

116. How can you tell that a number is divisible by 2? By 5?

A number is divisible by 3 when the sum of its digits (figures) is divisible by 3; it is divisible by 9 when the sum of its digits is divisible by 9.

A number is divisible by 4 when the number expressed by its last two figures is divisible by 4.

When is a number divisible by 25?

A fraction is reduced to *lowest terms* by dividing the numerator and the denominator by their greatest common divisor.

## 117. Written Exercises.

1. Reduce  $\frac{123}{400}$  to its lowest terms.

A look at both terms shows that 3 is a common factor. This reduces the fraction to  $\frac{41}{100}$ . 41 is a prime number, and is not a factor of 100, so that  $\frac{41}{100}$  cannot be reduced to lower terms.

2. Reduce  $\frac{432}{111}$  to its lowest terms.

$$4 + 3 + 2 = 9; \quad 6 + 2 + 1 = 9.$$

Since the sum of the digits of each term is divisible by 9, this number is a common factor, and reduces the fraction to  $\frac{4}{3}$ , etc.

3. Reduce  $\frac{420}{84}$  to its lowest terms.

5 is clearly a common factor, etc.

Reduce to lowest terms:

4.  $\frac{144}{168}$

8.  $\frac{275}{560}$

12.  $\frac{512}{610}$

5.  $\frac{375}{800}$

9.  $\frac{28}{112}$

13.  $\frac{224}{432}$

6.  $\frac{144}{176}$

10.  $\frac{81}{88}$

14.  $\frac{576}{810}$

7.  $\frac{182}{176}$

11.  $\frac{51}{89}$

15.  $\frac{180}{204}$

118. Reduce to its lowest terms  $\frac{169}{1001}$ .

In this example, it is not easy to ascertain by inspection any number that will divide both terms. In such cases, the greatest common

divisor is found by dividing the denominator by the numerator. The remainder is divided into the numerator, and each subsequent remainder is divided into the corresponding divisor until there is no longer a remainder. This last divisor is the *greatest common divisor* of the two numbers.

The numerator, 169, is contained in the denominator, 1001, 5 times with 156 remainder. This remainder is contained in the numerator, 169, one time with 13 remainder. This remainder is contained in the previous divisor, 156, 12 times with no remainder.

$$\begin{array}{r}
 5 \\
 169 \overline{)1001} \\
 \underline{845} \quad 1 \\
 156 \overline{)169} \\
 \underline{156} \quad 12 \\
 13 \overline{)156} \\
 \underline{13} \\
 26 \\
 \underline{26} \\
 0
 \end{array}$$

13 is the greatest common divisor.

$$\frac{169 \div 13}{1001 \div 13} = \frac{13}{77} \text{ lowest terms.}$$

NOTE.—In reducing fractions to lowest terms, the method of finding the greatest common divisor given above should not be resorted to if it is possible to get along without it.

### 119. Written Exercises.

Reduce to lowest terms:

1.  $\frac{42}{55}$

5.  $\frac{217}{248}$

9.  $\frac{51}{88}$

2.  $\frac{111}{121}$

6.  $\frac{78}{221}$

10.  $\frac{112}{187}$

3.  $\frac{49}{91}$

7.  $\frac{68}{158}$

11.  $\frac{115}{161}$

4.  $\frac{52}{65}$

8.  $\frac{77}{182}$

12.  $\frac{248}{345}$

SUGGESTION.—Do not waste time in finding the greatest common divisor.

13.  $\frac{25}{100}$

17.  $\frac{375}{1000}$

21.  $\frac{875}{1000}$

14.  $\frac{40}{100}$

18.  $\frac{36}{100}$

22.  $\frac{3125}{10000}$

15.  $\frac{28}{1000}$

19.  $\frac{625}{1000}$

23.  $\frac{88}{1000}$

16.  $\frac{125}{1000}$

20.  $\frac{64}{1000}$

24.  $\frac{825}{10000}$

## LEAST COMMON MULTIPLE.

120. The smallest number that is a multiple of two or more numbers is called the *least common multiple* of such numbers.

## 121. Oral Exercises.

Give the least common multiple of:

1. 16 and 24

6. 2, 3, 5, 9, 10

2. 12 and 15

7. 2, 3, 5, 6, 9, 10

3. 3, 9, 11

8. 3, 6, 9, 12, 4, 18

4. 4, 12, 16

9. 2, 7, 14, 3, 9

5. 2, 3, 4, 5, 6

10. 5, 10, 20, 25, 50

## 122. Written Exercises.

Find the least common multiple of 3, 9, 7, 14, 6, 14, 2, 12.

3 is stricken out since it is a factor of 6, which is one of the numbers. 7 is a factor of 14, one 14 is stricken out. 6 is a factor of 12. 2 is a factor of 12. The least common multiple of the remaining numbers, 9, 14, and 12, is to be found.

Divide these numbers by a prime number that is exactly contained in any two of them, bringing down the numbers that are not multiples of the divisor.

Taking 2 as a divisor, bring down 9, and write quotients 7 and 6.

3 being a factor of two of the three numbers, 9, 7, 6, is taken as the next divisor. 3 is written as a quotient, 7 is brought down, 2 is a quotient.

As there is no factor common to any two of the numbers, 3, 7, 2, we find the least common multiple by multiplying together the two divisors and these three numbers.

$$2 \times 3 \times 3 \times 7 \times 2 = 252 \text{ L. C. M.}$$

## 123. Find the L. C. M. of:

1. 4, 6, 3, 5, 8, 20

2. 9, 15, 15, 4, 4, 12, 25

Strike out 4, 3, 5.

Strike out one 15 and two 4's.

3. 2, 3, 5, 7, 5, 14, 10, 12, 24  
 4. 2, 3, 5, 6, 8, 10, 15, 16, 80  
 5. 20, 30, 40, 50  
 6. 2, 3, 4, 6, 8, 12, 16, 24  
 7. 24, 12, 5, 3, 10, 18                      9. 18, 5, 9, 40, 16  
 8. 11, 3, 7, 77, 33                      10. 10, 12, 15, 21

**ADDITION AND SUBTRACTION OF FRACTIONS.**

**124.** In adding or subtracting fractions, they must be reduced to a common denominator.

The *least common denominator* is the least common multiple of the denominators.

**125.** Add the fractions,  $\frac{2}{4}, \frac{11}{20}, \frac{5}{6}, \frac{17}{30}, \frac{23}{45}, \frac{7}{12}$ .

2	<u>4</u>	20	6	30	45	12	Strike out 4 and 6.
2		10		<u>15</u>	45	6	Strike out 15, a factor of 45.
		5		45	3		Strike out 5 and 3, factors of 45.

$$\text{L. C. M.} = 2 \times 2 \times 45 = 180.$$

	180
$\frac{2}{4}$	135
$\frac{11}{20}$	99
$\frac{5}{6}$	150
$\frac{17}{30}$	102
$\frac{23}{45}$	92
$\frac{7}{12}$	105
<u>Ans. <math>3\frac{1111}{180}</math></u>	$\frac{1111}{180} = 3\frac{1111}{180}$

To add, reduce the fractions to a common denominator, add the numerators, and place the sum over the common denominator. Reduce if possible.

To subtract, reduce the fractions to a common denominator, subtract the numerators, and place the difference over the common denominator. Reduce if possible.

**NOTE.**—In the following examples, determine the least common denominator by *inspection*, if possible.

126. Add:

1.  $8\frac{1}{4}, 5\frac{1}{4}, 3\frac{1}{4}$

6.  $\frac{1}{3}, \frac{2}{5}, \frac{1}{10}, \frac{3}{20}, \frac{1}{15}$

2.  $45\frac{1}{2}, 20\frac{1}{2}, 8\frac{1}{2}, 9\frac{1}{2}$

7.  $63\frac{1}{10}, 3\frac{1}{5}, 2\frac{1}{5}, 5\frac{1}{5}, 7\frac{1}{10}$

3.  $32\frac{1}{4}, 19\frac{1}{2}, 6\frac{1}{2}, 8\frac{1}{4}$

8.  $5\frac{1}{2}, 18\frac{1}{10}, 3\frac{1}{5}, 7\frac{1}{5}, 8\frac{1}{4}$

4.  $2\frac{1}{3}, 20, 3\frac{1}{3}, \frac{5}{12}, 5\frac{1}{3}$

9.  $4\frac{2}{100}, 7\frac{9}{100}, 84, 6\frac{7}{1000}, \frac{23}{100}$

5.  $8\frac{1}{5}, 45\frac{2}{5}, 2\frac{1}{10}, 4\frac{1}{2}, \frac{1}{10}$

10.  $17\frac{9}{1000}, \frac{27}{100}, 6\frac{2}{10}, \frac{15}{1000}, \frac{1}{100}$

11. Work No. 9 as an example in decimals.

12. Work No. 10 as an example in decimals.

127. Subtract:

13.  $65\frac{1}{2} - 57\frac{5}{8}$

18.  $251\frac{2}{11} - 27\frac{1}{11}$

14.  $18\frac{1}{10} - 9\frac{2}{5}$

19.  $755\frac{1}{8} - 283\frac{3}{4}$

15.  $100\frac{1}{4} - 15\frac{1}{2}$

20.  $123\frac{1}{2} - 80\frac{1}{2}$

16.  $102\frac{3}{8} - 27\frac{1}{4}$

21.  $100\frac{1}{100} - 89\frac{7}{100}$

17.  $208\frac{1}{2} - 128\frac{1}{8}$

22.  $67\frac{1}{10} - 58\frac{1}{100}$

23. Work No. 21 as an example in decimals.

24. Work No. 22 as an example in decimals.

128. Perform the operations indicated:

25.  $\frac{21+5}{25+5} - \frac{21}{25}$

26.  $\frac{21}{25} - \frac{21-5}{25-5}$

27.  $(37\frac{1}{2} - 11\frac{1}{2}) - (28\frac{7}{8} - 19\frac{1}{8})$

28.  $14\frac{5}{8} - 8\frac{1}{2} - 3\frac{3}{8} + 4\frac{1}{4}$

29.  $(8\frac{2}{8} + 6\frac{1}{2}) - (8\frac{2}{8} - 6\frac{1}{2})$

30.  $4\frac{3}{4} \times 16 \times 8\frac{1}{2}$
31.  $(2\frac{3}{8} + 5\frac{1}{8}) + (1\frac{1}{8} + 2\frac{1}{8} + 3\frac{1}{8})$
32.  $(8\frac{1}{2} + 4\frac{1}{2}) + (2\frac{1}{2} + 1\frac{3}{4})$
33.  $(3\frac{5}{12} \times 36) \times 8\frac{3}{4}$
34.  $4\frac{3}{8} + 3\frac{1}{2} - 6\frac{5}{8} + 17\frac{1}{8} - 9\frac{3}{8}$

129. Oral Problems.

1. A person travelling from New York to Albany (140 miles apart) has gone  $102\frac{3}{4}$  miles. How much farther has he to go?

2. There are 196 pounds of flour in a barrel. How many pounds in  $\frac{1}{4}$  barrel?

3. How many fourths in  $24\frac{3}{4}$ ?

4. Reduce  $\frac{4}{8}$  to lowest terms.

5. Change  $1\frac{9}{10}$  to a mixed number.

6. Add  $\frac{1}{2}$ ,  $\frac{1}{3}$ , and  $\frac{1}{4}$ .

7. From a chest of tea containing  $45\frac{1}{2}$  pounds,  $14\frac{3}{4}$  pounds are sold. How many pounds remain?

8. From  $\frac{1}{2}$  of a dollar take  $10\frac{3}{4}$  cents.

9. How many cents in  $\frac{1}{4} + \frac{1}{8} + \frac{3}{16}$  of a dollar?

10. A farmer has  $60\frac{3}{4}$  acres of pasture and  $20\frac{3}{4}$  acres of woodland. How many acres in both?

11. Considering the circumference of a circle as  $3\frac{1}{2}$  times its diameter, find the circumference of a circle whose diameter is 8 feet.

12. Mary is  $12\frac{7}{12}$  years old; Jane is  $3\frac{1}{12}$  years older. How old is Jane in years and months?

13. In a year and a half William will be 7 years 2 months old. How old is he now?

+

*What have these marked problems to do with fractions?*

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Chapter Two.

- 14. What number multiplied by 3 equals 231?
- 15. What number between 7 and 12 is a prime number?
- 16. A boy received 9 marks in arithmetic, 8 in penmanship, and 7 in reading. What was his average mark?
- 17.  $\frac{4}{5}$  of a class consists of boys. How many girls in the class, if it contains 49 pupils?
- 18. When July 1 falls upon Tuesday, what will be the date of the third Tuesday of July?
- 19. If July 1 falls upon Thursday, upon what day will the first of August fall?
- 20. A man bought  $20\frac{1}{2}$  pounds of sugar; he sold  $10\frac{1}{2}$  pounds at one time and  $6\frac{1}{2}$  pounds at another. How much had he left?
- 21. If 3 quarts 1 pint of oil cost 7 cents, what will 1 gallon 1 quart cost?
- 22. How much will have to be paid for 7 cows at \$50 each, and 4 horses at \$150 each?
- 23.  $\frac{3}{4}$  = how many hundredths?
- 24. What are the two factors of 87?
- 25. Find the G. C. D. of 36 and 54.
- 26. If eggs are sold at the rate of 21 for 25 cents, how much will be paid for  $5\frac{1}{2}$  dozen?

SUGGESTION. — Every member of the class should be required to solve one of the foregoing examples as a sight problem, first reading it from the book, and then giving the answer. No time should be wasted in "analyzing" the problems, unless some pupil desires the explanation of one that he does not understand.

At another time, the teacher should read, say, five or ten problems, requiring the answer to each to be written, at a given signal, and the pencil laid down before the next is read. No alteration of an answer should be permitted.

130. Written Problems.

1. A horse travelled  $48\frac{3}{10}$  miles in one day,  $56\frac{1}{4}$  the next,  $40\frac{1}{2}$  the third, and  $45\frac{1}{4}$  the fourth. How far did he travel in all?

2. To the sum of  $6\frac{7}{8}$  and  $19\frac{3}{4}$  add their difference.

3. From a bin containing  $25\frac{3}{4}$  bushels of grain there were taken out  $5\frac{1}{4}$  bushels at one time and  $6\frac{1}{2}$  at another. How much remained?

4. A merchant sold 4 pieces of cloth containing  $27\frac{1}{4}$  yards,  $26\frac{3}{4}$  yards,  $29\frac{1}{8}$  yards, and  $28\frac{1}{8}$  yards, respectively. How much did he receive for the cloth at 96 cents per yard?

5. Reduce  $\frac{1}{3}\frac{2}{5}\frac{3}{7}$  to lowest terms.

6. A man has  $8\frac{5}{8}$  bushels of peanuts. He puts them into bags holding  $\frac{1}{4}$  bushel. How many bags does he fill?

7. A 160-acre farm consists of five fields; the first contains  $17\frac{3}{4}$  acres, the second  $29\frac{1}{4}$  acres, the third  $35\frac{7}{8}$  acres, the fourth  $22\frac{3}{5}$  acres. How many acres are there in the fifth field?

8. From a piece of silk that contained  $28\frac{1}{2}$  yards, there were sold  $2\frac{1}{2}$  yards,  $6\frac{1}{8}$  yards, and  $13\frac{3}{4}$  yards. Find the value of the remainder at \$1.20 per yard.

9. Three pieces of cloth bought at \$2 per yard cost \$150. The first piece measures  $23\frac{1}{2}$  yards, the second measures  $30\frac{3}{4}$  yards. How many yards in the third piece?

10. What part of a person's income remains after he spends  $\frac{1}{3}$ ,  $\frac{1}{5}$ , and  $\frac{1}{4}$  of it?

11. A boy loses  $\frac{1}{2}$  of his marbles, and he gives away  $\frac{1}{4}$  of them. If he has 17 marbles left, how many had he at first?

12. A dealer sells  $1\frac{1}{2}$  gross,  $3\frac{1}{4}$  gross, and  $8\frac{3}{4}$  gross of lead pencils at 36 cents per dozen. How much does he receive for all?

1 gross = 12 dozen.



13. There are four towns, A, B, C, and D, on a certain railroad running east and west. A is  $41\frac{1}{2}$  miles west of C; D is  $39\frac{1}{4}$  miles east of B; B is  $22\frac{1}{2}$  miles west of C. How many miles from A to D? Make a diagram.

### CANCELLATION.

#### 131. Preliminary Exercises.

1. Divide 64 by 16. The quotient is 4.
2. Divide  $\frac{1}{2}$  of 64 by  $\frac{1}{2}$  of 16; i.e.  $32 \div 8$ .
3. Divide  $\frac{1}{4}$  of 64 by  $\frac{1}{4}$  of 16; i.e.  $16 \div 4$ .
4. Divide  $\frac{1}{8}$  of 64 by  $\frac{1}{8}$  of 16; i.e.  $8 \div 2$ .

In each case the quotient is 4.

In example 2 we took out of the dividend 64 the factor 2, making the new dividend 32; and we took out of 16 the same factor, making the new divisor 8.

In example 3 we took what factor out of the divisor and the dividend? What common factor was taken out in example 4?

Rejecting the same factor from the divisor and the dividend does not change the quotient.

In reducing  $\frac{2}{12}$  to  $\frac{1}{6}$  what factor common to the numerator and the denominator of the first fraction is rejected? Is the value of the first fraction altered by this rejection?

*Cancellation* is the striking out of common factors from the divisor and the dividend.

#### 132. Oral Exercises.

- |                              |                              |                               |                               |
|------------------------------|------------------------------|-------------------------------|-------------------------------|
| 1. $\frac{36 \times 14}{9}$  | 5. $\frac{42 \times 23}{21}$ | 9. $\frac{67 \times 36}{18}$  | 13. $\frac{83 \times 36}{12}$ |
| 2. $\frac{37}{8} \times 16$  | 6. $\frac{4}{23} \times 46$  | 10. $\frac{32}{41} \times 82$ | 14. $\frac{15}{16} \times 48$ |
| 3. $12 \times \frac{43}{24}$ | 7. $32 \times \frac{67}{96}$ | 11. $4 \times \frac{93}{12}$  | 15. $15 \times \frac{87}{30}$ |
| 4. $\frac{25 \times 18}{36}$ | 8. $\frac{33 \times 12}{99}$ | 12. $\frac{89 \times 13}{26}$ | 16. $\frac{44 \times 17}{34}$ |

# Fractions.

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## RATIO.

*No explanation  
or preliminary work*

### 133. Preliminary Exercises.

1. If oranges are worth 28 cents a dozen, what will be the cost of 3 oranges?
2. What part of a dozen is 3?
3. What is the ratio of 3 to 12?

*Compare Smith  
Int Ar p 217*

**Ratio** is the relation between two like numbers. It is found by dividing the first by the second.

4. What is the ratio of 12 to 16?
5. If 16 apples cost a certain sum, what part of this sum should be paid for a dozen apples?

### 134. Written Exercise.

1. If 17 horses cost \$4000, what will be the cost of 51 horses at the same price for each?

Since the ratio between 51 and 17 is  $\frac{3}{1}$ , or 3, 51 horses will cost 3 times \$4000, or \$12,000.

2. If 15 eggs cost 25 cents, what will 10 dozen cost?

The ratio of 10 dozen eggs to 15 eggs is  $\frac{10 \times 12}{15}$ .

Multiply 25 cents by  $\frac{10 \times 12}{15}$ .

In this case, 15 is not contained in any number above the line. We divide 15 and 10 by 5, canceling them and writing quotients 3 and 2 alongside. 3 is contained in 12 4 times; so we cancel 3 and 12. Our answer now is 25 cents  $\times 2 \times 4 = 200$  cents, or \$2.

$$\begin{array}{r} 25 \times \frac{2}{\cancel{10}} \times \frac{4}{\cancel{12}} \\ \hline 200 \\ \hline \end{array}$$

3. Eighteen men can do a piece of work in 26 days. How long will it take 13 men to do the same work?

Thirteen men will do the work in  $\frac{18}{13}$  of the time required by 18 men.

*Here, under fractions & rates is where Walsh introduces interest.*

4. Seventeen barrels of flour, 196 pounds each, were put into bags holding 49 pounds each. How many bags of flour were put up?

> 5. At the rate of 23 cents for 7 pounds, how much would be paid for 91 pounds of flour?

6. A bank pays \$4 interest a year on every \$100. How much interest will be paid for 3 years on \$650?

7. At \$7.50 per thousand for bricks, what must I pay for 63,200 bricks?

8. If flour is \$6 per barrel (196 lb.), what must be paid for a 49-pound bag?

9. A grocer buys 84 dozen eggs, and sells them at the rate of 21 eggs for 25 cents. What does he receive for them?

10. A miller buys 9840 pounds of wheat at 90 cents per bushel of 60 pounds. How much does he pay for it?

11. What will be the cost of 64 sheep, if 18 cost \$198?

12. If 18 men can do a piece of work in 42 days, how long will it take 21 men to do the same work?

13. What will be the cost of 66 dozen pens at 42 cents per gross of 12 dozen?

14. A certain quantity of hay feeds 15 horses 56 days. How long will it feed 14 horses?

15. A merchant bought 9 pieces of cloth, each containing 24 yards, for \$189. What was the price per yard?

### MULTIPLICATION OF FRACTIONS

#### 135. Preliminary Exercises.

What is  $\frac{1}{2}$  of 2 fifths? Of 4 sevenths? Of 6 elevenths?

What is  $\frac{1}{2}$  of  $\frac{1}{3}$ ? Of  $\frac{1}{4}$ ? Of  $\frac{1}{5}$ ? Show by diagram.

What is  $\frac{1}{2}$  of  $\frac{2}{3}$ ? Of  $\frac{3}{4}$ ? Of  $\frac{4}{5}$ ? Of  $\frac{5}{6}$ ?

What is  $\frac{1}{3}$  of  $\frac{1}{2}$ ?  $\frac{2}{3}$  of  $\frac{1}{2}$ ?  $\frac{3}{4}$  of  $\frac{1}{2}$ ?

What is  $\frac{1}{2}$  of  $\frac{3}{4}$ ?  $\frac{3}{4}$  of  $\frac{3}{4}$ ?  $\frac{3}{8}$  of  $\frac{3}{4}$ ?

What is  $\frac{1}{4}$  of  $\frac{1}{2}$ ?  $\frac{1}{4}$  of  $\frac{3}{4}$ ?  $\frac{3}{4}$  of  $\frac{1}{2}$ ?  $\frac{3}{4}$  of  $\frac{3}{4}$ ?

What is the half of  $1\frac{1}{2}$ ? Of  $2\frac{1}{2}$ ? Of  $3\frac{1}{2}$ ? Of  $4\frac{1}{2}$ ?

What is one-third of  $1\frac{1}{2}$ ?  $\frac{2}{3}$  of  $1\frac{1}{2}$ ?  $\frac{1}{3}$  of  $2\frac{1}{2}$ ?  $\frac{2}{3}$  of  $2\frac{1}{2}$ ?

### 136. Written Exercises.

1. Multiply  $\frac{2}{3}$  by  $\frac{3}{4}$ .

This means to find  $\frac{2}{3}$  of  $\frac{3}{4}$ .

Since  $\frac{1}{2}$  of  $\frac{1}{2} = \frac{1}{4}$ ,  $\frac{1}{2}$  of  $\frac{3}{4} = \frac{3}{8}$ , and  $\frac{2}{3}$  of  $\frac{3}{4} = \frac{2}{4}$ , or  $\frac{2}{3} \times \frac{3}{4} = \frac{2}{4}$ .

*One fraction is multiplied by another by placing the product of the numerators over the product of the denominators in the form of a fraction.*

NOTE. — Cancel when possible.

2. Multiply  $\frac{2}{3}$  by  $1\frac{2}{10}$ .

$$\frac{2}{3} \text{ of } 1\frac{2}{10} = 1\frac{2}{10} \quad \frac{2}{3} \text{ of } 1\frac{2}{10} = 2 \text{ times } 1\frac{2}{10} = \frac{2}{3}$$

Cancel 2 and 10, writing 5 under 10. Cancel 3 and 9, writing 3 above 9.

$$\frac{2}{3} \times \frac{9}{10} = \frac{3}{5}$$

Show by a diagram that 2 times  $1\frac{1}{10}$  is  $1\frac{2}{10}$ .

3. Multiply  $12\frac{1}{2}$  by  $3\frac{4}{10}$ .

Reduce the mixed numbers to improper fractions.

$$\frac{17}{8\cancel{0}} \times \frac{4\cancel{9}}{1\cancel{0}} = \frac{119}{3} = 39\frac{2}{3}$$

4. Multiply 117 by  $3\frac{2}{3}$ .

The multiplication of an integer by a mixed number, or of a mixed number by an integer, can be considered as multiplication of fractions, the integer being written as an improper fraction with 1 for the denominator.

$$\frac{13}{1} \times \frac{29}{3} = 377$$

## 137. Multiply:

- |                                       |                                                            |
|---------------------------------------|------------------------------------------------------------|
| 1. $\frac{2}{3}$ by 96                | 16. $\frac{5}{14} \times 8\frac{3}{4}$                     |
| 2. 128 by $\frac{3}{4}$               | 17. $3\frac{2}{3}$ by $12\frac{1}{2}$                      |
| 3. $\frac{4}{5}$ by $\frac{7}{8}$     | 18. $\frac{7}{8} \times 4\frac{1}{2}$                      |
| 4. $\frac{5}{6}$ by $\frac{7}{8}$     | 19. $\frac{5}{7}$ by $\frac{8}{9}$ by $1\frac{1}{2}$       |
| 5. $\frac{3}{4}$ by $\frac{5}{6}$     | 20. $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{7}{8}$        |
| 6. $3\frac{5}{12}$ by 72              | 21. $1\frac{1}{2} \times \frac{5}{7} \times \frac{9}{11}$  |
| 7. $24\frac{2}{3}$ by 18              | 22. $\frac{1}{2}$ of $1\frac{1}{2}$ of $2\frac{1}{2}$      |
| 8. $69\frac{2}{3}$ by 32              | 23. $\frac{7}{8}$ of $65\frac{3}{4}$                       |
| 9. $111\frac{4}{5}$ by 28             | 24. $\frac{3}{4}$ of $55\frac{5}{8}$                       |
| 10. 67 by $1\frac{5}{7}$              | 25. $6\frac{1}{2} \times 7\frac{3}{4}$                     |
| 11. $2\frac{1}{2}$ by $3\frac{2}{3}$  | 26. $4\frac{1}{2} \times 5\frac{1}{2}$                     |
| 12. $\frac{9}{8} \times 2\frac{3}{4}$ | 27. $\frac{2}{3}$ of $4\frac{1}{2} \times 3\frac{2}{3}$    |
| 13. $17\frac{1}{2}$ by $6\frac{2}{3}$ | 28. $\frac{5}{7}$ of $3\frac{1}{2} \times 4\frac{1}{11}$   |
| 14. $6\frac{1}{8} \times \frac{4}{7}$ | 29. $1\frac{1}{2} \times 2\frac{1}{3} \times 3\frac{1}{2}$ |
| 15. $4\frac{1}{2}$ by $8\frac{4}{5}$  | 30. $2\frac{1}{2} \times 2\frac{1}{3} \times 2\frac{1}{4}$ |

## 138. Perform the indicated operations:

NOTE. —  $\frac{1}{2}$  of  $8\frac{1}{2}$  is the same as  $\frac{1}{2} \times 8\frac{1}{2}$ , or  $3\frac{1}{2} \times \frac{1}{2}$ .

- |                                                                         |                                                                         |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1. $\frac{1}{3}$ of $(3\frac{1}{2} + 6\frac{1}{2})$                     | 6. $(8\frac{2}{3} \times 21) - (\frac{1}{3} \text{ of } 15\frac{5}{6})$ |
| 2. $(3\frac{1}{8} - 2\frac{1}{2}) \times \frac{5}{8}$                   | 7. $5\frac{1}{2} + 6\frac{2}{3} + 7\frac{3}{4}$                         |
| 3. $\frac{1}{4}$ of $(5\frac{1}{5} - 3\frac{2}{3})$                     | 8. $18\frac{5}{8} - 3\frac{2}{3} - 7\frac{1}{8}$                        |
| 4. $(24\frac{1}{3} + 16\frac{1}{6}) \div 8$                             | 9. $\frac{2}{3}$ of $\frac{3}{4}$ of $(3\frac{1}{2} + 1\frac{1}{4})$    |
| 5. $(3\frac{1}{4} + 2\frac{1}{8}) \times (3\frac{1}{4} - 2\frac{1}{8})$ | 10. $(18\frac{1}{6} - 6\frac{3}{8}) \div 11$                            |

## 139. Oral Exercises.

1. Sold a house lot for \$30, which was  $\frac{2}{3}$  of what it cost me. What was the cost of the lot?

2. A man can mow  $6\frac{2}{3}$  acres of grass in a day. How much can he mow in 6 days?

3. A man bought 15 bushels of corn for  $7\frac{1}{2}$  dollars. How much did a bushel cost?

4. A boy is 18 years old and his age is  $\frac{3}{4}$  of the age of his father. How old is his father?

5. Cloth is worth  $\frac{2}{10}$  of a dollar a yard. What is  $\frac{5}{8}$  of a yard worth?

6. At the rate of 5 cents for  $\frac{1}{4}$  of a pie, for how many pies will a man receive \$1.60?

7. What would  $\frac{4}{5}$  of a yard of carpet cost at  $\frac{3}{4}$  of a dollar a yard? ✓

8. I had  $\frac{5}{12}$  of a pound of candy and gave away  $\frac{3}{4}$  of it. What part of a pound did I give away?

9. What will 15 yards of ribbon cost at  $6\frac{2}{3}$  cents a yard?

10. What will  $2\frac{2}{3}$  gallons of ice-cream cost at  $1\frac{1}{4}$  dollars a gallon?

#### 140. Written Exercises.

1. A man worked 6 days at  $2\frac{3}{4}$  dollars per day, his son 5 days at  $1\frac{1}{4}$  dollars, his daughter 4 days at  $\frac{4}{5}$  of a dollar. What were their total earnings?

2. A merchant bought a piece of cloth for  $28\frac{3}{4}$  dollars and was obliged to sell it for  $\frac{4}{5}$  of what it cost him. How much did he lose?

3. A hotel in one month used 31 pounds of coffee and  $7\frac{2}{3}$  times as much sugar. How much sugar was used?

4. A man gave  $124\frac{5}{8}$  acres of land to his two sons, giving  $\frac{3}{5}$  of it to the elder and  $\frac{2}{5}$  to the younger. How many acres did each receive?

5. If it requires  $21\frac{3}{4}$  days for a man to dig a ditch, what part can he dig in 15 days?

6. If a bird can fly  $10\frac{1}{2}$  miles in  $\frac{1}{2}$  of an hour, how far can it fly in  $2\frac{1}{2}$  hours?

7. What would be the cost of a side of veal containing 52 pounds at  $9\frac{1}{2}$  cents a pound?

8. What will 16 pairs of shoes cost at  $\$3\frac{1}{2}$  a pair?

9. A man who owed  $\$7825$  failed and could pay only  $\frac{1}{5}$  of his debts. How much could he pay?

10. I bought a house and lot and made a payment of  $\$4500$ , which was  $\frac{2}{5}$  of the cost. What was the cost of the property?

### DIVISION OF FRACTIONS.

#### 141. Preliminary Exercises.

1. If 3 yards of calico cost 18 cents, what is the price per yard?

$18 \div 3$ , or  $\frac{1}{3}$  of 18¢. The latter may be written  $18 \div \frac{1}{3}$ .

2. If  $1\frac{1}{2}$  yards of dress goods cost 18¢, what is the price per yard?

$18 \div 1\frac{1}{2}$ , or  $18 \div \frac{3}{2}$ .

To divide 18 by  $\frac{3}{2}$ , we can change 18 to halves and proceed as follows:  $\frac{36}{2} \div \frac{3}{2} = 36 \div 3$ .

The following are the steps: 18 is multiplied by 2, and the product is divided by 3, or  $\frac{18 \times 2}{3}$ , which is the same as  $18 \times \frac{2}{3}$ .

That is,  $18 \div \frac{3}{2} = 18 \times \frac{2}{3}$ .

3. If 3 yards of dress goods are required to make a waist, how many waists can be made out of 18 yards?

The number of waists =  $18 \div 3 = \frac{1}{3}$  of 18 =  $18 \times \frac{1}{3}$ .

That is,  $18 \div \frac{3}{1} = 18 \times \frac{1}{3}$ .

4. If an apron requires  $1\frac{1}{2}$  yards of material, how many aprons can be made out of 18 yards?

The number of aprons =  $18 \div 1\frac{1}{2} = 18 \div \frac{3}{2} = 18 \times \frac{2}{3}$ .

5. If it takes three-quarters of a pound of flour to make a loaf of bread, how many loaves can be made with 18 pounds of flour?

$$\text{The number of loaves} = 18 \div \frac{3}{4} = 18 \times \frac{4}{3}.$$

6. At three-quarters of a dollar each, how many dolls can be bought for a dollar and a half?

$$\$1\frac{1}{2} \div \$\frac{3}{4} = \$\frac{3}{2} \div \$\frac{3}{4} = \$\frac{3}{2} \times \frac{4}{3}.$$

To divide by  $\frac{3}{4}$  (examples 1 and 3), we multiply by  $\frac{4}{3}$ .

To divide by  $\frac{2}{3}$  (examples 2 and 4), we multiply by  $\frac{3}{2}$ .

To divide by  $\frac{1}{2}$  (examples 5 and 6), we multiply by  $\frac{2}{1}$ .

*To divide by a fraction, multiply by the divisor inverted.*

7. Divide 8 by  $\frac{4}{5}$ .

$$8 \div \frac{4}{5} = 8 \times \frac{5}{4} = 10, \text{ Ans.}$$

8. Divide  $\frac{3}{4}$  by 10.

$$\frac{3}{4} \div 10 = \frac{3}{4} \times \frac{1}{10} = \frac{3}{40}, \text{ Ans.}$$

9. Divide  $6\frac{1}{2}$  by 9.

$$6\frac{1}{2} \div 9 = \frac{1}{9} \text{ of } 2\frac{1}{2} = \frac{5}{18}, \text{ Ans.}$$

142. Divide:

1.  $\frac{3}{4} \div 4$

4.  $\frac{4}{11} \div \frac{2}{11}$

7.  $\frac{4}{16} \div \frac{1}{16}$

9.  $\frac{4}{7} \div 3\frac{3}{7}$

2.  $\frac{5}{7} \div 10$

5.  $\frac{1}{6} \div \frac{4}{16}$

8.  $3\frac{3}{8} \div \frac{5}{8}$

10.  $\frac{1}{2} \div \frac{2}{3}$

3.  $1\frac{3}{4} \div 5$

6.  $\frac{2}{11} \div \frac{4}{11}$

143. Written Exercises.

1. Divide  $\frac{9}{16}$  by  $\frac{3}{20}$ .

$$\frac{9}{16} \div \frac{3}{20} = \frac{9}{16} \times \frac{20}{3} = \frac{15}{4} = 3\frac{3}{4}$$

2. Divide  $15\frac{4}{11}$  by 13.

Changing the mixed number to an improper fraction, we have,

$$15\frac{4}{11} \div 13 = \frac{169}{11} \div 13 = \frac{169}{11} \times \frac{1}{13} = \frac{13}{11} = 1\frac{2}{11}$$



Divide:

3.  $\frac{2}{10} \div \frac{2}{16}$

8.  $\frac{4}{11} \div 6\frac{2}{11}$

13.  $8\frac{7}{16} \div 3\frac{1}{8}$

4.  $5 \div 1\frac{3}{4}$

9.  $\frac{1}{2}\frac{1}{4} \div 8\frac{5}{24}$

14.  $9\frac{7}{8} \div 3\frac{1}{2}$

5.  $8\frac{3}{8} \div 11$

10.  $\frac{4}{9} \div \frac{5}{8}$

15.  $18\frac{1}{2} \div 11\frac{3}{8}$

6.  $4\frac{5}{11} \div 17$

11.  $\frac{2}{15} \div \frac{1}{7}$

16.  $23\frac{1}{2} \div 6\frac{5}{7}$

7.  $24\frac{1}{8} \div 20$

12.  $\frac{2}{11} \div \frac{2}{16}$

NOTE.—The pupil should prove his answers to each of the foregoing examples by multiplying the quotient by the divisor. If his answer is correct, this product will equal the dividend.

144. Perform operations indicated:

17.  $(3\frac{3}{8} \times 4\frac{1}{2}) - 10\frac{1}{4}$

24.  $(\frac{1}{8} \times \frac{3}{5}) + (4\frac{1}{3} \times 6\frac{1}{6})$

18.  $(13\frac{3}{8} - 7\frac{3}{8}) \times \frac{3}{4}$

25.  $34\frac{5}{8} - 17\frac{5}{8} + 20\frac{1}{4}$

19.  $(20 \times \frac{3}{4}) \div \frac{7}{8}$

26.  $18\frac{5}{8} + 24\frac{7}{12} - 36\frac{1}{6}$

20.  $(20 \div \frac{7}{8}) \times \frac{3}{4}$

27.  $\frac{5\frac{3}{8} \times 9 \times 7\frac{3}{8}}{4\frac{3}{8} \times \frac{5}{8}}$

21.  $20 \div (\frac{7}{8} \times \frac{3}{4})$

28.  $\frac{5\frac{1}{2} \times 7\frac{3}{4} \times 3\frac{1}{4} \times 6\frac{1}{2}}{2\frac{3}{4} \times 4\frac{1}{8} \times 31}$

22.  $(20 \div \frac{7}{8}) \div \frac{3}{4}$

23.  $(14\frac{3}{4} \times 7) - (9 \times 10\frac{7}{8})$

145. Oral Problems.

Give analysis of each:

1. If base-balls are worth  $\frac{3}{4}$  of a dollar each, what will be the cost of 16 base-balls?

NOTE.—The pupil is frequently at a loss to determine whether a given problem in fractions involves multiplication or division. In such a case, he should substitute for the fraction a whole number to ascertain the proper operation. While in example 1 a pupil would analyze without hesitation: "If base-balls are worth  $\$ \frac{3}{4}$  each, 16 balls would cost 16 times  $\$ \frac{3}{4}$ ," he might stumble at No. 2. By reading the problem, "Paid a certain sum for base-balls at  $\$ 3$  each," he would see that the number of balls is ascertained by division. His analysis would then be, "If base-balls are  $\$ \frac{3}{4}$  each, I can buy as

many balls as there are  $\$ \frac{1}{4}$  in  $\$ 12$ ." The work would be  $12 \div \frac{1}{4} = 12 \times \frac{4}{1}$ . He could complete the solution by finding  $\frac{1}{4}$  of 12, taking  $\frac{1}{4}$  of 12 as 4, etc. Another method of solving this problem mentally, is to change the price to a whole number and to make a corresponding change in the cost. "Paid 4 times  $\$ 12$  for base-balls at 4 times  $\$ \frac{1}{4}$  each; i.e.  $\$ 48$  for balls at  $\$ 3$  each."

2. Paid  $\$ 12$  for base-balls, at  $\frac{1}{4}$  of a dollar each. How many were bought?

3. What is the cost of 2 feet of ribbon at 30 cents per yard?

4. Find how much a yard of ribbon is worth, if  $\frac{2}{3}$  yard costs 20 cents.

5. If it takes  $\frac{1}{4}$  yard of material to make a child's waist, how many can be made from a piece containing 24 yards?

6. If 18 jackets require 24 yards of cloth, how much is needed for 1 jacket?

7. A man had 60 acres of land. How many acres had he left after selling  $\frac{2}{3}$  of his land?

8. After spending  $\frac{2}{3}$  of his money, a person had  $\$ 26$  remaining. How much money had he at first?

9. When tea is  $\$.50$  per pound, how much can be bought for  $\$.75$ ?

10. If tea is worth  $\frac{3}{4}$  of a dollar per pound, how much can be bought for  $\frac{1}{2}$  of a dollar?

11. When silk is selling at  $\$.75$  per yard, how much can be bought for one-fourth of a dollar?

12. Find the cost of a gallon of milk at the rate of 9 cents for 3 pints.

13.  $\frac{3}{4}$  of a gallon of milk costs 9 cents. What is the price per gallon?

14.  $\frac{2}{3}$  of what number is 12?

15. 1 yard and 1 foot of wire cost 16 cents. How much must be paid for a yard?

## 146. Written Problems.

1. How much does a man earn in a day if he earns  $45\frac{1}{2}$  dollars in a month of 26 working days?
2. When flour is  $5\frac{1}{4}$  dollars per barrel, how many barrels can be bought for 294 dollars?
3. If coffee is  $37\frac{1}{2}$  cents per pound, how many pounds can be bought for 60 dollars?
4. A man divided 16 dollars among some boys, giving to each  $1\frac{2}{3}$  dollars. How many boys received a share?
5. Paid  $38\frac{1}{2}$  dollars for  $6\frac{1}{2}$  cords of wood. What was the price per cord?
6. How many steps will it take to walk 2640 feet, each step being  $2\frac{1}{2}$  feet in length?
7. A man put  $40\frac{1}{2}$  bushels of barley into bags holding  $1\frac{1}{2}$  bushels. How many bags were required?
8. In  $2\frac{1}{4}$  acres of land, how many building lots of  $\frac{2}{3}$  of an acre?
9. If  $\frac{2}{3}$  of a farm is worth \$8000, what is  $\frac{1}{3}$  of it worth?
10. The product of two factors is  $9\frac{7}{12}$ ; one factor is  $3\frac{1}{2}$ . What is the other?

## SPECIAL DRILLS — REVIEW.

## 147. Give sums at sight:

- |                                    |                 |                 |
|------------------------------------|-----------------|-----------------|
| 1. $59 + 75 = 59 + 70 + 5 =$       |                 |                 |
| 2. $48 + 63$                       | 5. $88 + 22$    | 8. $66 + 56$    |
| 3. $69 + 47$                       | 6. $94 + 38$    | 9. $29 + 94$    |
| 4. $67 + 83$                       | 7. $61 + 39$    | 10. $65 + 86$   |
| 11. $560 + 390 = 560 + 300 + 90 =$ |                 |                 |
| 12. $270 + 280$                    | 14. $430 + 480$ | 16. $420 + 280$ |
| 13. $640 + 260$                    | 15. $250 + 390$ | 17. $780 + 260$ |

*fractions but  
here instead of  
one p 84 as  
index indicates*

18.  $225 + 154 = 225 + 150 + 4 =$

19.  $315 + 421$

21.  $540 + 355$

23.  $172 + 304$

20.  $437 + 260$

22.  $248 + 131$

24.  $517 + 329$

148. Give remainders at sight:

1.  $134 - 75 = 134 - 70 - 5 =$

2.  $150 - 83$

5.  $124 - 89$

8.  $100 - 61$

3.  $132 - 94$

6.  $112 - 56$

9.  $124 - 35$

4.  $122 - 56$

7.  $180 - 89$

10.  $132 - 38$

11.  $750 - 290 = 750 - 200 - 90 =$

12.  $510 - 220$

14.  $820 - 560$

16.  $910 - 550$

13.  $630 - 380$

15.  $730 - 440$

17.  $380 - 290$

18.  $279 - 154 = 279 - 150 - 4 =$

19.  $386 - 263$

21.  $668 - 325$

23.  $386 - 123$

20.  $457 - 237$

22.  $279 - 125$

24.  $721 - 468$

149. Give products at sight:

1.  $49 \times 4 = 4 \text{ forties} + 4 \text{ nines.}$

2.  $47 \times 3$

3.  $48 \times 4$

4.  $43 \times 5$

5.  $46 \times 6$

6.  $38 \times 7$

7.  $123 \times 3 = 3 \text{ times one twenty three} = \text{three sixty nine.}$

8.  $431 \times 2$

10.  $332 \times 3$

12.  $232 \times 3$

9.  $122 \times 4$

11.  $242 \times 2$

13.  $31 \times 24$

14.  $47 \times 25 = \frac{1}{2} \text{ of } 47 \text{ hundred} = 11\frac{1}{2} \text{ hundred} = 1175.$

15.  $25 \times 38 = 38 \times 25 = \frac{1}{4} \text{ of } 38 \text{ hundred} = 9\frac{1}{2} \text{ hundred.}$

16.  $32 \times 25$

18.  $44 \times 25$

20.  $49 \times 25$

17.  $25 \times 33$

19.  $25 \times 45$

21.  $63 \times 25$

150. Give quotients at sight:

1.  $925 \div 25 = 9\frac{1}{2} \text{ hundred} \div \frac{1}{4} \text{ hundred} = 9\frac{1}{2} \div \frac{1}{4} = 9\frac{1}{2} \times 4.$

2.  $875 \div 25$

4.  $725 \div 25$

6.  $575 \div 25$

3.  $625 \div 25$

5.  $450 \div 25$

7.  $350 \div 25$

## 151. Oral Problems.

1. Find the cost of a pound of tea at 75 cents, and a piece of ham at 56 cents.

2. A farmer sold 58 sheep from his flock of 121 sheep. How many remained?

3. What will be paid for 8 pounds of coffee at 35¢ per pound?

4. A laborer received \$4.88 for four days' work. How much did he earn per day?

5. At \$40 each, how many cows can be purchased for \$2000?

6. Bought 20 pounds of sugar at 5¢ per pound, and  $2\frac{1}{2}$  pounds of butter at 30¢. What was the amount of my bill?

7. A piece of cloth measuring  $31\frac{1}{2}$  yards was divided into 2 equal parts. Find the length of each.

8. How many weeks in a year of 366 days?

9. If I pay 25 cents for 3 pounds of cherries, how many pounds can I buy for \$1.25?

10. Find the cost of a bushel and a peck of peanuts at the rate of 5 cents per quart.

11. A farmer had 164 acres of land. How much had he left after selling 87 acres?

12. Find the total number of pounds in 3 tubs of butter weighing respectively 25 pounds, 34 pounds, and 36 pounds.

13. At 60¢ per pound, how much tea can be bought for \$5.85?

14. A drover paid \$219 for oxen, at an average price of \$73. How many did he buy?

15. What will be the cost of 20 bushels of wheat at \$1.04½ per bushel?

16. At 24¢ per pound, how many ounces of butter can be bought for 18¢?

17. A woman pays \$540 per year for a house. What is the rent per month?

18. How many weeks in 294 days?

19. At 72¢ per yard, what will be the cost of 2 ft. 11 in. of lace? ✓

20. How much does a grocer receive for a barrel of flour, 196 pounds, retailed at 3 cents per pound?

21. If 47 men can do a piece of work in 4 days, how long will it take 1 man to do the same work?

22. Find the cost of 36 acres of land at \$25 per acre.

23. If it takes  $3\frac{1}{2}$  yards of cloth to make a coat, how many coats can be made from  $24\frac{1}{2}$  yards?

24. How much will be paid for 84 yards of silk at \$1 $\frac{1}{4}$  per yard?

25. If a certain quantity of provisions will last one man 215 days, how long will it last 43 men?

26. How many square yards are there in a rectangular field 36 yards long and 25 yards wide?

### 152. Written Exercises.

1. What is the sum of 94,625; 215; 5172; 819,365; 121?

2. Bought 172 acres of land for \$860. What was that an acre?

3. In a classroom there are 54 pupils; each pupil spent \$2.75 for books this year. How much money was spent for books by the whole class?

4. By the census of 1890, Massachusetts had a population of 2,238,943; in 1900, it had a population of 2,805,346. What was the gain?

5. How many boxes of strawberries at \$.15 a box can I get for \$1.20?

6. What is a proper fraction? An improper fraction? Define numerator, denominator, a mixed number.

7. Add  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ , and  $\frac{1}{5}$ .

8. If 7 pairs of shoes cost \$12 $\frac{1}{2}$ , how much will one pair cost?

9.  $\frac{4}{7} \div \frac{2}{14} \div \frac{8}{21} = ?$

10. What is the product of  $\frac{2}{10}$ ,  $\frac{3}{8}$ ,  $\frac{1}{3}$ , and  $\frac{3}{5}$ ?

11.  $8\frac{1}{2} \times 7\frac{2}{3} = ?$

12. Paid  $\frac{3}{4}$  of a dollar for potatoes,  $\frac{1}{2}$  of a dollar for apples, and  $\frac{2}{10}$  of a dollar for sugar. How much did I pay for all?

13. Divide  $2\frac{1}{2}$  by  $1\frac{1}{2}$ .

14. Find the difference between  $4\frac{2}{3}$  and  $3\frac{1}{2}$ .

15.  $\frac{2}{3} + \frac{2}{5} + \frac{5}{18} = ?$

### MULTIPLICATION OF DECIMALS.

#### 153. Oral Problems.

1. When the French franc is worth 19.3 cents; what is the value of the 20-franc piece in United States money?

2. What is the equivalent of 10 German marks, the mark being quoted at 23 $\frac{8}{10}$  cents?

3. A man paid 100 pounds sterling for a piano. Find the cost in U. S. money at \$ 4.8665 per pound sterling.

NOTE. — \$ 4.8665 may be read 4 dollars 86 cents 6 mills and 5 tenths of a mill, a mill being one-tenth of a cent.

4. A meter contains 39.37 inches. How many inches in 100 meters?

5. One kilogram = 2.2046 pounds. What is the equivalent of 1000 kilograms, in pounds?

NOTE. — .2046 is read 2046 ten-thousandths.

6. How many square yards are there in a piece of ground 40 yards long and 12.5 yards wide?

7. How many ounces in 2.5 pounds?
8. Change .75 hour to minutes.
9. Find the perimeter of a square, each side of which measures 10.25 feet.

## 154. Written Exercises.

1. Multiply 38.4 by 6.37.

Place the units' figure (6) of the multiplier under the last figure (4) of the multiplicand. 6 times 4 tenths = 24 tenths = 2.4; write .4 under the multiplier 6, and carry 2; etc. Next multiply by .3, or  $\frac{3}{10}$ .  $\frac{6}{10} \times \frac{3}{10} = \frac{18}{100}$ , or .12. Write 2 in the hundredths' place, and carry 1 tenth; etc. Multiply finally by .07, or  $\frac{7}{100}$ .  $\frac{6}{100} \times \frac{7}{10} = \frac{42}{1000}$ , or .028. Write 8 in the thousandths' place, etc.

$$\begin{array}{r}
 38.4 \\
 \times 6.37 \\
 \hline
 230.4 \\
 11.52 \\
 2.688 \\
 \hline
 244.608 \\
 \text{Ans. } 244.608.
 \end{array}$$

NOTE. — By writing the units' figure of the multiplier under the last figure of the multiplicand, and by taking care to place the right-hand figure of each partial product under the corresponding figure of the multiplier, the decimal points in the partial products and the total will naturally fall under the decimal point in the multiplicand.

2. Multiply 12.34 by 56.7.

$$\begin{array}{r}
 12.34 \\
 \times 56.7 \\
 \hline
 617.0 \\
 74.04 \\
 8.638 \\
 \hline
 699.678
 \end{array}$$

While pupils should occasionally begin to multiply by the left-hand figure (5) of the multiplier, some may prefer to begin with the right-hand figure (7). It will be noted that the number of decimal places in the product equals the sum of those in the multiplier and the multiplicand.

$$\begin{array}{r}
 12.34 \\
 \times 56.7 \\
 \hline
 8.638 \\
 74.04 \\
 617.0 \\
 \hline
 699.678
 \end{array}$$

*Multiply as in whole numbers, and from the right of the product point off as many decimal places as there are decimal places in both factors.*

## 155. Multiply:

1.  $32 \times 2.5$

2.  $3.2 \times 25$

3.  $6.4 \times 4.5$

4.  $7.2 \times 3.75$



5.  $12.8 \times 5.7$

8.  $5.625 \times 8.4$

6.  $9.6 \times 1.125$

9.  $1.875 \times 12.8$

7.  $34.9 \times 2.34$

10.  $42.36 \times 2.95$

NOTE. — The pupil should correct any error he may make in placing the decimal point by estimating the approximate answer. The answer to example 3, for instance, is more than 2 times 32 and less than 3 times 32. In example 3, it is more than 4 sixes and less than 5 sevens.

11.  $1.75 \times 64$

16.  $18.4 \times 20.25$

12.  $8.375 \times 40$

17.  $11.16 \times 42.40$

13.  $24.5 \times 18.2$

18.  $66.6 \times 3.3\frac{1}{2}$

14.  $9.6 \times 12\frac{1}{2}$

19.  $6.24 \times 1.75$

15.  $7.43 \times 3.6$

20.  $400.04 \times 39.25$

### 156. Oral Problems.

1. I owned 40 acres of land and sold .25 of it. How many acres did I sell?

2. A boy bought 15 hens, which was .6 of what he already had. How many had he at first?

3. A lawyer charged me .11 of the money for collecting \$100. How many dollars did he charge?

4. If I earn \$8 in a week, how much can I earn in 7.5 weeks?

5. .75 of a class of 44 were promoted. How many were not promoted?

6. What is the surface of a table 4 feet wide and 6.25 feet long?

7. .5 of a yard is how many feet? How many inches?

8. A man bought 3.5 yards of cloth at \$5 a yard. What was the price?

9. 25 miles is .5 of the distance between two cities. What is the distance?

10. In a box were 100 oranges; .08 of them became spoiled. How many sound ones were left?

## 157. Written Problems.

1. How many yards are there in 25 pieces of carpeting if each piece contains 32.75 yards?

2. A mill uses 95.6 tons of coal per day. How many tons will it use in 42.25 days?

3. A cubic foot of water weighs 62.5 pounds; ice is .92 as heavy as water. What is the weight of a cubic foot of ice?

4. I bought 3 loads of wood, the first containing 1.04 cords, the second 1.05 cords, and the third .946 cord. What did it cost me at \$4.50 a cord?

5. A gallon of water weighs 8.33 pounds. What is the weight of a gallon of milk which is 1.03 times as heavy as water?

6. A wheel in making one revolution travels 15.03 feet. How far will it travel in 25 revolutions?

7. A ship sails 18.54 miles in an hour. How far will she sail in 15.5 hours? *No ship ever sailed 18.54 miles an hour*

8. Find the cost of concreting a cellar 24.5 feet long by 14.25 feet wide, at 30 cents per square foot.

9. A quantity of provisions will last 25 men 12.75 days. How long will it last one man?

10. Two men start from the same place and travel in opposite directions, one at the rate of 3.85 miles per hour, and the other at the rate of 4.12 miles per hour. How far apart will they be at the end of 13 hours? Make a diagram.

## DIVISION OF DECIMALS.

## 158. Divide 42 by 2.1.

Changing the decimal fraction in the divisor to a common fraction, we have

$$42 \div 2\frac{1}{10} = \frac{42}{1} \div \frac{21}{10} = \frac{42}{1} \times \frac{10}{21} = \frac{420}{21}.$$

$$42 \div 2.1 = 420 \div 21.$$

NOTE. — When we change the divisor 2.1 to 21, we have multiplied it by 10, and the same change must be made in the dividend.

*Make the divisor a whole number, and make a corresponding change in the number of decimal places in the dividend. This reduces the numbers to the same denomination. If necessary to complete the operation, ciphers may be annexed to the dividend. The number of decimal places in the quotient is equal to the number in the dividend as changed.*

### 159. Written Exercises.

Divide:

$$1. \quad 80 \div 2.5$$

$$9. \quad 50 \div .25$$

$$2. \quad 8 \div 2.5$$

$$10. \quad 72 \div .5$$

$$3. \quad 840 \div 1.2$$

$$11. \quad 960 \div .03$$

$$4. \quad 36 \div 1\frac{2}{5}$$

$$12. \quad .847 \div .007$$

$$5. \quad 36 \div .9$$

$$13. \quad 27 \div .002$$

$$6. \quad 12.6 \div 6.3$$

$$14. \quad 10 \div .8$$

$$7. \quad 48 \div 15$$

$$15. \quad 1.263 \div .03$$

$$8. \quad 18.36 \div .6$$

$$16. \quad 19.63 \div .013$$

### 17. Divide 196.3 by .013.

Remove the decimal point in the divisor three places to the right, and make a corresponding change in the dividend, adding two ciphers.

To show where the decimal point originally belonged, draw a cancelation mark through it, instead of erasing it.

$$\begin{array}{r} 15 \ 100. \\ .013 \overline{) 196.300} \\ \underline{13} \phantom{00} \\ 66 \phantom{0} \\ \underline{65} \phantom{0} \\ 13 \phantom{0} \end{array}$$

When the divisor is thus made a whole number, the decimal point in the quotient will be placed under (or over) the new decimal point in the dividend.

$$1.736 \div 16$$

$$17.36 \div .16$$

$$.01736 \div 1.6$$

$$\begin{array}{r} .1085 \text{ Ans.} \\ 16 \overline{) 1.7360} \end{array}$$

$$\begin{array}{r} 108.5 \text{ Ans.} \\ .16 \overline{) 17.36.0} \end{array}$$

$$\begin{array}{r} .01085 \text{ Ans.} \\ 1.6 \overline{) .017360} \end{array}$$

18.  $.504 + .024$

19.  $5.04 + .24$

20.  $50.4 + 2.4$

21.  $504 + 24$

22.  $168 + .7$

23.  $36 + .12$

24.  $.875 + .25$

25.  $123.6 + .01$

26.  $392 + 3.2$

27.  $48 + 3000$

28.  $92 + .23$

29.  $.875 + 125$

30.  $381.17 + 8.11$

31.  $.624 + 9.75$

32.  $48.195 + 3.57$

33.  $829.31 + .019$

160. Divide 381.6 by 95.032.

NOTE. — The sign (+) after the last figure of the quotient indicates that there is a remainder.

$$\begin{array}{r}
 95,032 \overline{) 381,600.000} \quad 4.015 + \\
 \underline{380128} \phantom{000} \\
 147200 \\
 \underline{95032} \\
 521680
 \end{array}$$

161. Divide, carrying out the quotient to 3 places of decimals:

34.  $31 \div 13$

35.  $4.5 \div 17$

36.  $920.07 \div 46$

37.  $7.049 \div 1.6$

38.  $81.22 \div 3.275$

39.  $246.3 \div 93.473$

162. Write answers at sight:

NOTE. — To multiply .042 by 100, the decimal point is moved two places to the right; i.e.  $.042 \times 100 = 4.2$ ;  $.042 \times 200 = 4.2 \times 2 = 8.4$ .

1.  $.042 \times 200$

5.  $40 \times .7$

9.  $.121 \times 4000$

2.  $.13 \times 300$

6.  $25 \times .8$

10.  $.061 \times 500$

3.  $.014 \times 50$

7.  $234 \times .2$

11.  $.03 \times 1000$

4.  $8.1 \times 60$

8.  $.73 \times 30$

12.  $.012 \times 700$

NOTE. — Remember that  $369 \div 1000 = \frac{369}{1000} = 369 \text{ thousandths} = .369$ . To divide 369 by 3000, therefore, divide .369 by 3.

- |                  |                   |                  |
|------------------|-------------------|------------------|
| 13. $369 + 3000$ | 17. $2460 + 3000$ | 21. $4.68 + 20$  |
| 14. $219 + 300$  | 18. $196 + 4000$  | 22. $30.5 + 500$ |
| 15. $48.6 + 60$  | 19. $6 + 500$     | 23. $18.8 + 200$ |
| 16. $1.89 + 90$  | 20. $27.9 + 300$  | 24. $248 + 4000$ |

**163. Written Exercises.**

- |                                  |                                   |                                    |
|----------------------------------|-----------------------------------|------------------------------------|
| 1. $1728 \div 1200$              | 2. $172.8 \div 1200$              | 3. $1.728 \div 1200$               |
| $12\overline{)17.28} \downarrow$ | $12\overline{)1.72} \downarrow 8$ | $12\overline{).01} \downarrow 728$ |
| 1.44 Ans.                        | .144 Ans.                         | .00144 Ans.                        |

*Cancel the ciphers in the divisor, and remove the decimal point in the dividend a corresponding number of places to the left, prefixing ciphers if necessary.*

**164. Divide:**

- |                      |                       |
|----------------------|-----------------------|
| 1. $2436 \div 3000$  | 7. $45 \div 800$      |
| 2. $136.5 \div 1300$ | 8. $25.2 \div 240$    |
| 3. $84.8 \div 80$    | 9. $345.6 \div 1200$  |
| 4. $100.1 \div 700$  | 10. $4004 \div 110$   |
| 5. $1 \div 40$       | 11. $5.28 \div 60$    |
| 6. $2.2 \div 50$     | 12. $907.5 \div 1500$ |

**165. Oral Problems.**

- I cut 8.72 yards of cloth into 8 equal pieces. How long was each piece?
- I divided .75 of a pound of candy equally among 3 girls. What part of a pound did each receive?
- I divided .5 of a pound of cherries among 4 children. What part of a pound did each receive?
- 49 rods is .7 of the distance round a field. How many rods of fence will enclose the field?
- 24 yards of matting cover .8 of my floor. How many yards more must I buy?

6. 40 pounds are .4 of my weight. What do I weigh?
7. I spent 2.5 dollars, which was .5 of what I had. How much had I?
8. 36 square inches are .25 of a square foot. How many square inches in a square foot?
9. A collector receives .05 of all the money he collects. How much did he collect to earn \$15?
10. At 75 cents each, how many chairs can be bought for \$12?

#### 166. Written Problems.

1. If 35.84 cubic feet of water weigh a ton, what will be the weight of 2458.6 cubic feet?
2. How many francs are there in \$150? (A franc equals 19.3¢.)
3. If a barrel of flour costs \$5.75, how many barrels can be bought for \$258.75?
4. If \$640.05 are paid for 75.3 tons of coal, what is the price per ton?
5. There are 31.5 gallons in a barrel. How many barrels are there in 2787.75 gallons?
6. I have 96 cubic feet of wood; this is .75 of a cord. How many cubic feet in 1 cord?
7. A man earns \$162 in 13.5 weeks. What are his wages per week?
8. I bought a farm of 71.5 acres for \$6220.50. What did it cost me per acre?
9. There are 2150.4 cubic inches in a bushel. How many bushels are there in 9676.8 cubic inches?
10. The wheel of a bicycle is 7.25 feet around. How many times will it turn in going a mile, or 5280 feet?

## UNITED STATES MONEY.

## FRACTIONAL PARTS OF A DOLLAR.

## 167. Oral Problems.

1. How many 50-cent base-balls can be bought for \$ 15 ?  
( $15 \div \frac{1}{2}$ , i.e.  $15 \times 2$ )
2. How many 75-cent base-balls can be bought for \$ 15 ?  
( $15 \div \frac{3}{4}$ , i.e.  $15 \times \frac{4}{3}$ )
3. At 75¢ per pound, how much tea can be bought for \$ 1 ?
4. How many hats, at \$ 1.25 each, can be bought for \$ 15 ?  
( $15 \div 1\frac{1}{4}$ )
5. Paid \$ 16 for coffee at 25¢ per pound. How many pounds were purchased ?
6. At 33 $\frac{1}{3}$ ¢ per pound, how many pounds of butter can be bought for \$ 32 ?
7. Find the number of yards of ribbon, at 12 $\frac{1}{2}$ ¢ per yard, that will cost \$ 45.
8. At 6 $\frac{1}{4}$ ¢ per bar, how many bars of soap will cost \$ 11 ?
9. If 4 pieces of violet soap are sold for 25¢, how many can be bought for \$ 9 ?
10. \$ 24 is paid for corn at 75¢ per bushel. How many bushels are bought ?
11. I spent \$ 30 for lace at 66 $\frac{2}{3}$ ¢ per yard. How many yards did I buy ?
12. For \$ 36 how many pairs of rubber shoes can be bought at 37 $\frac{1}{2}$ ¢ per pair ?
13. Oats are 62 $\frac{1}{2}$ ¢ per bushel. How many bushels will \$ 40 buy ?
14. A farmer pays 87 $\frac{1}{2}$ ¢ per bushel for seed rye. If his bill amounted to \$ 21, how many bushels did he purchase ?

15. A storekeeper sold \$33 worth of collars, at  $16\frac{1}{2}$ ¢ each. How many did he sell?

16. At the rate of 3 for 50¢, how many collars can be bought for \$25?

17. Corn is worth 20¢ per can. How many cans will cost \$32?

18. Find the cost of 35 yards of cloth, at \$1.25 per yard.

19. At \$1.25 per yard, how many yards of cloth can be bought for \$35?

20. How many pairs of gloves, at \$1.75 per pair, will cost \$28?

21. When coal is \$5.25 per ton, how many tons can be bought for \$42?

22. Cost of 16 pairs of shoes at \$2.75?

23. 33 jackets at \$3.33 $\frac{1}{3}$ ? 24. 18 yards cloth at \$2.16 $\frac{2}{3}$ ?

25. Paid \$26 for cloth at \$2.16 $\frac{2}{3}$  per yard. How many yards did I buy?

26. Find the cost of 16 pairs of skates at \$1.87 $\frac{1}{2}$  per pair.

27. If sheep cost \$3.12 $\frac{1}{2}$  each, how many can I get for \$75?

28. How many 25-cent balls can be bought for \$8.75?

29. Divide 775 by 25. 30. Divide \$8.25 by 75¢.

31. How many square feet are there in a lot 96 feet long, 100 feet wide? In a lot 96 feet long, 25 feet wide?

32. Find the total cost of 32 head of cattle at \$75 per head.

33. How much must be paid for 32 cows at \$37.50 each?

34. If sheep are worth \$3.75 each, how much will a farmer receive for 32 sheep?

35. If a train goes at the rate of 25 miles per hour, how many hours will it take to go 675 miles?



## DENOMINATE NUMBERS.

**NOTE.** — For the tables of Denominate numbers used in these lessons, see section 93, pages 43–44.

## 168. Written Exercises.

1. Change 17 lb. 4 oz. to ounces.

Since there are 16 ounces in 1 pound, in 17 pounds there are 272 ounces, etc.

$$\begin{array}{r}
 16 \text{ oz.} \\
 \times 17 \\
 \hline
 112 \\
 16 \phantom{0} \\
 \hline
 272 \text{ oz.} \\
 \text{Add } 4 \text{ oz.} \\
 \hline
 276 \text{ oz.} \quad \text{Ans.}
 \end{array}$$

2. Change 37 gal. 3 qt. to quarts.

In this example, we are to multiply 4 quarts (the number in a gallon), by 37, and to add 3 quarts to the product. In practice, however, 4 is taken as the multiplier, and the three quarts are added in. We say 4 sevens are 28, and 3 are 31, writing the 1; 4 threes are 12, and 3 are 15.

$$\begin{array}{r}
 4 \text{ qt.} \\
 37 \text{ gal. } 3 \text{ qt.} \\
 \hline
 151 \text{ qt.} \quad \text{Ans.}
 \end{array}$$

3. Change 45 bushels to quarts.

Write as here shown, placing above 0 pecks the number of pecks in a bushel, and above 0 quarts the number of quarts in a peck. Multiply 4 pecks by 45, and write the product, 180 pecks, in the proper column; multiply 8 quarts by 180, etc.

$$\begin{array}{r}
 4 \text{ pk.} \quad 8 \text{ qt.} \\
 45 \text{ bu.} \quad 0 \text{ pk.} \quad 0 \text{ qt.} \\
 \hline
 180 \text{ pk.} \quad 1440 \text{ qt.} \\
 \text{Ans. } 1440 \text{ qt.}
 \end{array}$$

Change:

4. 63 qt. 1 pt. to pints.
5. 27 bu. 3 pk. to pecks.
6. 48 pk. 7 qt. to quarts.
7. 84 pk. to pints.
8. 7 mi. 60 rd. to rods.
9. 13 hr. 20 min. to minutes.
10. 18 wk. 3 da. to days.

**11. Change 151 quarts to gallons and quarts.**

Write above 151 quarts the number of quarts in a gallon. Divide 151 by 4 to obtain the number of gallons, 37. Write the remainder, 3, in the column of quarts.

$$\begin{array}{r} 4 \text{ qt.} \\ \underline{151 \text{ qt.}} \\ 37 \text{ gal. } 3 \text{ qt. } \textit{Ans} \end{array}$$

**12. Change 228 inches to yards and feet.**

Divide the number of inches, 228, by 12, to obtain the number of feet, 19. Write this to the left of 228 inches. Reduce to yards by dividing by 3.

$$\begin{array}{r} 3 \text{ ft. } 12 \text{ in.} \\ \underline{19 \text{ ft. } 228 \text{ in.}} \\ 6 \text{ yd. } 1 \text{ ft. } \textit{Ans} \end{array}$$

**13. 87 pints to quarts and pints.**

**14. 250 feet to yards and feet.**

**15. 1650 rods to miles and rods.**

**16. 864 hours to weeks.**

**17. 296 quarts to bushels and pecks.**

**18. 315 ounces to pounds and ounces.**

**19. 743 months to years and months.**

**20. 15,000 minutes to days and hours.**

**21. Add 3 ft. 6 in., 9 ft. 5 in., 12 ft. 3 in.**

Write the feet in one column and the inches in another. The sum of the column of inches is 14 inches, or 1 foot 2 inches. Write 2 inches, and carry 1 foot to the next column.

$$\begin{array}{r} 3 \text{ ft. } 6 \text{ in.} \\ 9 \text{ ft. } 5 \text{ in.} \\ \underline{12 \text{ ft. } 3 \text{ in.}} \\ 25 \text{ ft. } 2 \text{ in. } \textit{Ans} \end{array}$$

**22. 30 min. 15 sec. + 30 min. 18 sec. + 45 min. 24 sec.**

**23. 9 yr. 3 mo. + 18 yr. 7 mo. + 22 yr. 2 mo.**

**24. 19 wk. 4 da. + 7 wk. 5 da. + 8 wk.**

**25. 9 mi. 169 rd. + 84 rd. + 3 mi. 67 rd.**

**26. 7 yd. 1 ft. + 33 yd. + 19 yd. 2 ft.**

**27. 18 gal. 1 qt. + 16 gal. 2 qt. + 15 gal. 3 qt.**

**28. 5 pk. 3 qt. + 6 qt. + 7 pk. 1 qt.**

29. 24 bu. 3 pk. + 24 bu. 3 pk. + 24 bu. 3 pk.

30. 12 qt. 1 pt. + 12 qt. 1 pt. + 12 qt. 1 pt. + 12 qt. 1 pt.

31. Multiply 12 qt. 1 pt. by 7.

7 times 1 pint = 7 pints = 3 quarts 1 pint. Write 12 qt. 1 pt.  
1 pint in the proper column, and carry 3 quarts.  $\times 7$   
7 times 12 quarts = 84 quarts. Carrying 3, we  $\frac{87 \text{ qt. 1 pt.}}{}$  *Ans.*  
get 87 quarts.

32. 12 qt. 1 pt.  $\times 4$

37. 15 wk. 3 da.  $\times 5$ .

33. 24 bu. 3 pk.  $\times 3$ .

38. 7 yr. 3 mo.  $\times 10$ .

34. 5 pk. 3 qt.  $\times 9$ .

39. 40 min. 35 sec.  $\times 2$ .

35. 18 gal. 1 qt.  $\times 8$ .

40. 9 ft. 5 in.  $\times 12$ .

36. 33 yd. 1 ft.  $\times 6$ .

41. From 25 ft. 3 in. take 18 ft. 7 in.

Take 7 inches from 1 foot 3 inches, or 25 ft. 3 in.  
15 inches. Carry 1 foot to 18 feet, making  $\frac{-18 \text{ ft. 7 in.}}{}$   
19 feet, etc.  $\frac{6 \text{ ft. 8 in.}}{}$  *Ans.*

42. 50 min. 13 sec. — 27 min. 30 sec.

43. 12 yr. 1 mo. — 5 yr. 11 mo.

44. 50 wk. 4 da. — 18 wk. 6 da.

45. 25 ft. — 18 ft. 7 in.

46. 33 yd. 1 ft. — 18 yd. 2 ft.

47. 240 gal. 1 qt. — 94 gal. 2 qt.

48. 83 pk. 3 qt. — 59 pk. 1 qt.

49. 170 bu. 1 pk. — 85 bu. 2 pk.

50. 135 qt. 1 pt. — 67 qt. 1 pt.

51. Divide 87 gal. 2 qt. by 5.

Dividing 87 gallons by 5, we get 17 gallons,  
and 2 gallons remainder. Change 2 gallons 5)87 gal. 2 qt.  
to 8 quarts, add in 2 quarts, making 10 quarts. 17 gal. 2 qt. *Ans.*  
Dividing 10 quarts by 5, we get 2 quarts.

52. 50 min. 35 sec. + 5

57. 387 gal. + 6

53. 156 yr. 9 mo. + 9

58. 222 bu. 3 pk. + 9

54. 73 wk. 2 da. + 3

59. 150 qt. + 4

55. 50 mi. 135 rd. + 7

60. 75 bu. + 8

56. 253 yd. 1 ft. + 10

61. Divide 87 qt. by 43 qt. 1 pt.

Change the divisor to 87 pints.  $\frac{43 \text{ qt. 1 pt.})}{87 \text{ pt.})} \frac{87 \text{ qt.}}{174 \text{ pt.}}$   
 Change the dividend to the same denomination. 87 pints is contained 2  
 times in 174 pints. 2      *Ans.*

62. 50 min. 35 sec. + 10 min. 7 sec.

63. 78 bu. + 9 bu. 3 pk.

64. 5 lb. 1 oz. + 9 oz.

65. 14 ft. 2 in. + 1 ft. 5 in.

## 169. Oral Exercises.

1. 3 pints is what part of a gallon?

(3 pints is what part of 8 pints?) *all 3 these problems are probable*

2. What part of a gallon is 1 qt. 1 pt.?

3. Find the ratio of
- $\frac{2}{3}$
- to
- $\frac{3}{4}$
- .

(Divide 10 fifteenths by 9 fifteenths.)

4. Find the ratio of
- $\frac{2}{3}$
- to
- $\frac{3}{4}$
- .

5. How many square feet in a rectangle 12 feet long, 13 feet wide?

- 6.
- $\frac{1}{2}$
- of a day is how many hours and minutes?

7. 14 ounces is what part of 2 pounds?

- 8.
- $\frac{3}{4}$
- foot is what part of a yard?

9. A strip of tape 3 yards long is cut into four equal pieces. How many feet and inches are there in each piece?

10. At \$30 per month, how much rent will be paid in 1 year, 8 months?

11.  $2\frac{1}{4}$  months is what part of a year?
12. At  $\frac{3}{4}$  of a dollar per pound, how much tea can I get for \$1?
13. How many square yards in a room 15 feet long, 18 feet wide?
14. A lot is 25 feet by 100 feet. How many feet of fence will it take to enclose it?
15. 1 pk. 1 qt. is what part of a bushel?
16. 15 is what part of 4 dozen?
17. Reduce  $\frac{5}{8}$  to lowest terms.

**170. Written Problems.**

1. Add 4 da. 6 hr., 9 da. 11 hr., 3 da. 7 hr.
2. What part of a week is 1 da. 18 hr.?
3. If a man receives \$60 interest per year, how much will he receive in 3 yr.  $7\frac{1}{2}$  mo.?
4. Reduce 3 da. 18 hr. to minutes.
5. How many days and hours are there in 8100 minutes?
6.  $\frac{75}{100}$  of a day is how many hours?
7. How many hours and minutes in .4 day?
8. A man receives \$1456 per year of 52 weeks. What is his salary per week?
9. Find the cost of 1 bu. 1 pk. 1 qt. of potatoes at 8 cents per half-peck.
10. A piece of meat weighing 27 lb. 12 oz. is divided among 6 persons. How many pounds and ounces does each receive?
11. How many bushels and pecks are there in 5 bags, each containing 1 bu. 1 pk?
12. How many gallons, quarts, and pints of ice-cream will be needed to give a half-pint to each one of 67 persons?

13. Find the cost of 7 lb. 10 oz. of tea at 40 cents per pound.

14. From a bin containing 20 bushels of wheat there were sold 10 bu. 3 pk. How much remained?

15. How many yards in a mile? How many feet? How many inches?

16. A field is 16 rods long, 12 rods wide. How many square yards does it contain? What is the perimeter in rods? In feet?

17. How many rails each 30 feet long will be needed for a single track road (two tracks) 40 miles long?

18. A boy steps 33 inches. How many steps will he take in going 2 miles?

19. December 20 the sun rises at Boston at 7.26 A.M. and sets at 4.30 P.M. How long is it between sunrise and sunset? How much longer is the day at Charleston, S. C., where the sun rises at 6.58 A.M. and sets at 4.57 P.M.?

20. On June 21 the sun rises at Boston at 4.23 A.M. and sets at 7.40 P.M. On the same day it rises at Charleston at 4.53 A.M. and sets at 7.11 P.M. What is the length of the day at each place?

#### MEASUREMENTS.

171. How many square yards in a floor 6 yards long, 5 yards wide?

How many square yards in a ceiling 18 feet long, 15 feet wide?

#### 172. Written Exercises.

1. How many square yards are there in a piece of ground 60 feet long and 30 yards wide?

60 feet = 20 yards. In a plot 20 yards by 30 yards the area = 1 square yard  $\times 20 \times 30 = 600$  square yards, *Ans.*

Calculate the number of square yards in the following.

First reduce each side to yards.

2. 18 yd. by 21 yd.

7. 33 ft. by 36 yd.

3. 54 ft. by 63 ft.

8. 27 ft. by 96 ft.

4. 72 in. by 108 in.

9. 54 ft. by 72 in.

5. 19 yd. by 47 yd.

10. 48 ft. by 45 ft.

6. 67 yd. by 89 yd.

11. 54 in. by 72 ft.

First indicate the operations ; then cancel.

12. Find the number of square yards in a room 18 ft 4 in. long, 22 ft. 6 in. wide.

$$18 \text{ ft. } 4 \text{ in.} = 18\frac{1}{3} \text{ ft.} = \frac{18\frac{1}{3}}{3} \text{ yd.} = \frac{55}{9} \text{ yd.}$$

$$22 \text{ ft. } 6 \text{ in.} = 22\frac{1}{2} \text{ ft.} = \frac{22\frac{1}{2}}{2} \text{ yd.} = \frac{45}{6} \text{ yd.}$$

$$\text{Area} = 1 \text{ sq. yd.} \times \frac{55}{9} \times \frac{45}{6}. \quad \text{Canceling, } \frac{55 \times \overset{5}{\cancel{45}}}{\cancel{9} \times 6} = \frac{275}{6} = 45\frac{5}{6}$$

Ans.  $45\frac{5}{6}$  sq. yd.

13. How many square yards in a room 13 ft. 1 in. long, 27 ft. wide ?

$$13 \text{ ft. } 1 \text{ in.} = 157 \text{ in.} = \frac{157}{36} \text{ yd.} \quad 27 \text{ ft.} = 9 \text{ yd.}$$

$$\text{Area} = 1 \text{ sq. yd.} \times \frac{157}{36} \times 9. \quad \frac{157 \times \cancel{9}}{\cancel{36}} = \frac{157}{4} = 39\frac{1}{4}$$

Ans.  $39\frac{1}{4}$  sq. yd.

14. How many square inches in 12 panes of glass, each 5 inches long, 7 inches wide ?

15. A piece of cloth is 48 yards long, 24 inches wide. How many square yards does it contain ?

16. A merchant imports 8 pieces of cloth, 36 yards to the piece. How many square yards of cloth are there, if it is 32 inches wide ?

17. A tight board fence 6 feet high surrounds a lot 25 feet front by 100 feet deep. How many square feet of boards in the front fence ? In the back fence ? In each side fence ? In the whole ? (Make diagrams.)

18. A room is 18 feet long, 15 feet wide, 12 feet high. How many square feet in the floor?

Draw a rectangle to represent the ceiling. Write the dimensions in their proper places, and write in the centre the number of square feet in its surface. Draw diagrams of the four walls; give dimensions and surface of each.

19. How many faces has a cube? If one edge of a cube measures 4 inches, how many square inches are there in the entire surface?

Suppose you wish to make a cube out of a single piece of paste-board. Make a drawing to show the shape of the piece needed, without allowing anything for overlapping parts.

20. The United States government charges a duty of 4¢ per square yard on imported cotton cloth. What duty must the importer pay on a piece containing 24 yards,  $\frac{3}{4}$  yard wide?

21. What will be the cost at \$1 per square yard for making a sidewalk 12 feet wide and 30 feet long?

BILLS.

173. NEW YORK, Oct. 1, 1904.  
MRS. WILLIAM JOHNSON,

*Bought of FUREY & COMPANY.*

1904						
Aug.	13	44 yd. Carpet	\$ .90			
	15	3 Oak Chairs	1.75			
		1 Rocker		12	—	
	19	18 yd. Oil-cloth	.50			
	27	1 Parlor Suit		75	—	
Sept.	19	6 Kitchen Chairs	.75			
		1 Table		4	50	
	26	36 yd. Matting	.33 $\frac{1}{3}$			
						\$



1. Copy the bill on the preceding page. Supply the missing amounts.

2. Charles W. Wise has bought the following goods of Thos. F. Farley & Co.:

Jan. 3, 1904, 50 pounds of sugar, at  $5\frac{1}{2}\phi$ ; 4 pounds of tea, at  $62\frac{1}{2}\phi$ . Jan. 4, 10 pounds of coffee, at  $32\frac{1}{2}\phi$ ; 2 barrels of flour, at \$5.75. Jan. 9, 24 bars of soap, at  $16\frac{3}{8}\phi$ ; 42 pounds of starch, at  $8\phi$ .

Make out a bill dated Feb. 1, 1904.

3. Make out a bill for the following articles bought during March and April. Supply the names of buyer and seller, also the dates:

$23\frac{1}{2}$  yards of silk, at  $80\phi$ ;  $1\frac{3}{4}$  yards of lace, at \$2.40; 64 yards of muslin, at  $6\frac{7}{8}\phi$ ; 8 spools of sewing silk, at  $7\phi$ ; 4 pairs of stockings, at  $65\phi$ ; 6 yards of linen, at  $87\frac{1}{2}\phi$ ;  $\frac{1}{2}$  dozen collars, at \$2.10.

4. Make out a bill for the following goods, bought June 15:

3 cases of torpedoes, at \$2.20; 12 boxes of firecrackers, at \$1.62 $\frac{1}{2}$ ; 3 gross pinwheels, at \$1.35; 5 gross sky-rockets, at \$3.25; 2 dozen balloons, at \$2.25; 45 lanterns, at  $9\phi$ .

NOTE. — The date is written only at the top of the bill when all the articles are bought at one time.

### SHORT METHODS — REVIEW.

If the school is to train for life, it must accustom pupils to use modes of calculation followed in the business world.

In their previous work, pupils have employed  $\$ \frac{1}{2}$  instead of 25¢,  $\$ \frac{1}{4}$  instead of 12 $\frac{1}{2}\phi$ , etc. They have, for instance, found the cost of 32 pounds at 25¢ per pound, by multiplying  $\$ \frac{1}{2}$  by 32. While the result in example 4 is the same, 25 pounds at 32¢, the analysis is different. The following is suggested:

100 pounds at 32¢ would cost \$32,  $\frac{1}{4}$  of 100 pounds would cost  $\frac{1}{4}$  of \$32, or \$8.

The rule generally given for the multiplication by 25 is to annex

two ciphers to the multiplicand and to divide by 4. In practice, the ciphers need not be annexed actually or mentally. To multiply 19 by 25, the pupil divides 19 by 4, getting 4 for quotient; to this he adds 75 for the 3 remainder, getting 475 for the result.

#### 174. Oral Exercises.

1. Multiply by 25:  
16, 19, 21, 23, 25, 29, 33, 36, 42, 48.
2. How many square feet in a lot 84 feet long, 25 feet wide?
3. What is the weight of 25 barrels of flour, each weighing 196 pounds?
4. Find the cost of 25 pounds of coffee at 32¢ per pound.
5. What will a woman have to pay for 25 yards of silk at \$1.60 per yard?
6. A man sold 25 cows at \$44 each. How much did he receive for them?
7. Multiply 64 by  $12\frac{1}{2}$ .
8. Find the cost of  $12\frac{1}{2}$  bushels of wheat at 96¢ per bushel.
9. At \$12.50 per barrel, how much should I pay for 56 barrels of pork?
10. How many pens in  $12\frac{1}{2}$  gross? (144 to gross.)
11. Find the cost of  $12\frac{1}{2}$  pounds of tea at 56¢ per pound.
12. How many square yards in a field 96 yards long, 75 yards wide?

#### 175. Sight Exercises.

To multiply 427 by 25 the pupil considers 4 as the divisor. He writes on his paper 1, then 0, then 6, annexing 75 for the 3 remaining.  
*Ans.* 10,675.

Example 5:  $25 \times 686$  is the same as  $686 \times 25$ .

Example 9: To multiply by 250, consider three ciphers annexed to the multiplicand. *what for*

**Example 11:** Divide by 8, annexing two ciphers to the quotient when there is no remainder. Annex  $12\frac{1}{2}$  when the remainder is 1; 25, when the remainder is 2; etc.

**Example 19:** Consider three ciphers annexed and divide by 8.

Write only the answers :

- |                     |                                |                                 |
|---------------------|--------------------------------|---------------------------------|
| 1. $837 \times 25$  | 8. $25 \times 2174$            | 15. $12\frac{1}{2} \times 1084$ |
| 2. $763 \times 25$  | 9. $837 \times 250$            | 16. $12\frac{1}{2} \times 2196$ |
| 3. $934 \times 25$  | 10. $763 \times 250$           | 17. $12\frac{1}{2} \times 3670$ |
| 4. $508 \times 25$  | 11. $864 \times 12\frac{1}{2}$ | 18. $12\frac{1}{2} \times 6281$ |
| 5. $25 \times 686$  | 12. $776 \times 12\frac{1}{2}$ | 19. $864 \times 125$            |
| 6. $25 \times 301$  | 13. $236 \times 12\frac{1}{2}$ | 20. $776 \times 125$            |
| 7. $25 \times 1039$ | 14. $404 \times 12\frac{1}{2}$ | 21. $125 \times 1020$           |

### 176. Sight Exercises.

Pupils do much unnecessary work in rearranging numbers and in writing fractions over again with a common denominator. A few of these examples should be written on the blackboard from time to time, and the teacher should require the pupil to write nothing but the answers.

Add :

- |                                  |                                   |                                   |
|----------------------------------|-----------------------------------|-----------------------------------|
| 1. $3\frac{1}{2} + 5\frac{1}{8}$ | 4. $11\frac{7}{8} + 4\frac{1}{2}$ | 7. $8\frac{3}{4} + 6\frac{7}{8}$  |
| 2. $4\frac{1}{2} + 8\frac{3}{4}$ | 5. $7\frac{3}{8} + 9\frac{7}{10}$ | 8. $15\frac{3}{8} + 8\frac{1}{2}$ |
| 3. $9\frac{3}{8} + 7\frac{5}{8}$ | 6. $5\frac{3}{4} + 2\frac{3}{8}$  | 9. $9\frac{3}{8} + 5\frac{3}{8}$  |

### 177. Subtract at sight :

- |                                      |                                     |                                     |
|--------------------------------------|-------------------------------------|-------------------------------------|
| 10. $23\frac{7}{10} - 19\frac{2}{5}$ | 14. $9\frac{7}{8} - 2\frac{1}{2}$   | 18. $35\frac{1}{8} - 3\frac{1}{2}$  |
| 11. $16\frac{3}{4} - 9\frac{3}{8}$   | 15. $10\frac{1}{2} - 5\frac{1}{2}$  | 19. $11\frac{7}{8} - 6\frac{1}{2}$  |
| 12. $18\frac{3}{8} - 3\frac{1}{4}$   | 16. $14\frac{1}{4} - 8\frac{3}{10}$ | 20. $43\frac{3}{10} - 8\frac{3}{4}$ |
| 13. $15\frac{3}{4} - 8\frac{1}{8}$   | 17. $27\frac{1}{9} - 7\frac{1}{3}$  | 21. $50\frac{1}{8} - 4\frac{3}{4}$  |

178. Multiply at sight,  $18\frac{3}{4} \times 4$ .

$\frac{3}{4} \times 4 = 3$ . 4 eights are 32, and 3 are 35 (put down 5). 4 ones are 4 and 3 are 7 (put down 7). *Ans.* 75.

The pupil should write only the answers.

22.  $27\frac{1}{2} \times 10$

27.  $15\frac{7}{8} \times 3$

32.  $37\frac{1}{2} \times 3$

23.  $33\frac{1}{8} \times 12$

28.  $13\frac{3}{4} \times 4$

33.  $45\frac{3}{8} \times 5$

24.  $16\frac{5}{8} \times 8$

29.  $20\frac{1}{2} \times 11$

34.  $23\frac{1}{8} \times 4$

25.  $17\frac{3}{4} \times 8$

30.  $40\frac{3}{8} \times 5$

35.  $17\frac{1}{4} \times 6$

26.  $19\frac{3}{8} \times 6$

31.  $16\frac{3}{4} \times 7$

179. Divide at sight.

When the divisor is an integer less than 12, the pupil should not reduce the mixed number in the dividend to an improper fraction. To divide  $246\frac{1}{4}$  by 3, the pupil first gets the whole number of the quotient 82, he then divides  $\frac{1}{4}$  by 3. *Ans.*  $82\frac{1}{4}$ .

In dividing  $248\frac{1}{4}$  by 4, the pupil obtains 62 as the quotient of 248 by 4; he then finds  $\frac{1}{4}$  of  $\frac{1}{4}$ , which is  $\frac{1}{16}$ . *Ans.*  $62\frac{1}{16}$ .

In dividing  $202\frac{1}{2}$  by 5, the quotient is 40, and the remainder is  $2\frac{1}{2}$ , which is reduced to  $\frac{1}{2}$ . One-fifth of this is  $\frac{1}{10}$ . *Ans.*  $40\frac{1}{10}$ .

In dividing  $183\frac{1}{4}$  by 6, the quotient is 30 with a remainder of  $3\frac{1}{4}$ , or  $\frac{1}{4}$ .  $\frac{1}{4}$  of  $\frac{1}{4} = \frac{1}{16}$ . *Ans.*  $30\frac{1}{16}$ .

36.  $3 \overline{)45\frac{3}{4}}$

41.  $8 \overline{)37\frac{1}{2}}$

46.  $7 \overline{)97\frac{3}{16}}$

37.  $4 \overline{)56\frac{1}{4}}$

42.  $9 \overline{)48\frac{1}{2}}$

47.  $10 \overline{)87\frac{1}{2}}$

38.  $12 \overline{)36\frac{1}{8}}$

43.  $6 \overline{)25\frac{1}{2}}$

48.  $4 \overline{)66\frac{3}{4}}$

39.  $5 \overline{)72\frac{1}{2}}$

44.  $7 \overline{)10\frac{1}{2}}$

49.  $3 \overline{)94\frac{1}{2}}$

40.  $11 \overline{)83\frac{3}{4}}$

45.  $6 \overline{)75\frac{3}{4}}$

50.  $5 \overline{)83\frac{1}{2}}$

### SIGHT APPROXIMATIONS.

180. Give approximate answers in whole numbers. Solve for the exact answers.

1.  $17\frac{3}{10} \times 3\frac{1}{2}$ ; or, about  $17 \times$  about 4.

2.  $25\frac{1}{10} \div \frac{2}{3}$ ; or, about  $25 \div \frac{1}{4}$  nearly.

- |                                        |                                          |
|----------------------------------------|------------------------------------------|
| 3. $6\frac{1}{2} \times 6\frac{1}{2}$  | 7. $799\frac{1}{2} \div 991\frac{1}{2}$  |
| 4. $300\frac{1}{5} \div 11\frac{3}{4}$ | 8. $7\frac{8}{100} \times 7\frac{2}{10}$ |
| 5. $86\frac{3}{4} \times 7\frac{1}{2}$ | 9. $7\frac{1}{2} \times 11\frac{1}{8}$   |
| 6. $35\frac{1}{4} \div 3\frac{1}{2}$   | 10. $64\frac{1}{8} \times \frac{3}{8}$   |

**181.** Give answers in whole numbers:

- |                                                               |                          |
|---------------------------------------------------------------|--------------------------|
| 1. $5.75 \times 9.999$ ; or, $5.75 \times 10$ nearly.         |                          |
| 2. $24.002 \div .4999$ ; or, $24 \div$ nearly $\frac{1}{2}$ . |                          |
| 3. $25.125 \times 11.834$                                     | 7. $799.9 \times .103$   |
| 4. $36.843 \div 6.105$                                        | 8. $7.999 \times 7.999$  |
| 5. $86.4 \div .983$                                           | 9. $7.001 \times 12.003$ |
| 6. $32.04 \times 5.001$                                       | 10. $64.001 \div .249$   |

**182.** Give the cost, approximately, of:

- 49 horses at \$199 each. ( $\$200 \times 49$ .)
- 199 yd. 2 ft. 11 in. of cloth at \$2.50 per yard.
- 3 lb. 15 oz. of butter at 25¢ per lb.
- 398 coats at \$12 each.
- 7 bu. 3 pk. 7 qt. potatoes at \$2 per bushel.
- 798 base-balls at 25 cents each.
- 19 gal. 3 qt. 1 pt. alcohol at \$2.49 per gallon.
- 995 lb. tea at  $59\frac{1}{4}$  cents per pound.
- 7 houses at \$4995 each.
- 507 pounds of hay at 99 cents per 100 pounds.

**183.** Oral Review Exercises.

- What is  $\frac{2}{3}$  of 60?  $\frac{3}{4}$  of 35?
- A man sold a boat for \$8, which was  $\frac{2}{3}$  of what it cost him. What did it cost him?
- A man having \$35, gave away  $\frac{2}{5}$  of it. How much had he left?

4. How many inches are there in  $\frac{3}{4}$  of a yard?  $\frac{3}{4}$  of a yard?  $\frac{5}{8}$  of a yard?
5. If 6 eggs cost 12 cents, what will 5 dozen cost?
6. How much is  $\frac{5}{8}$  less  $\frac{1}{4}$ ?  $\frac{1}{8}$  less  $\frac{1}{4}$ ?
7. Change to improper fractions:  $7\frac{3}{4}$ ,  $9\frac{1}{8}$ ,  $6\frac{3}{8}$ ,  $2\frac{8}{15}$ ,  $6\frac{7}{8}$ .
8. How many apples at 2¢ apiece are worth as much as 4 peaches at 5¢ apiece?
9. Which is the greater and how much:  $\frac{5}{8}$  of \$24, or  $\frac{4}{5}$  of \$25?
10. Change to mixed numbers:  $\frac{37}{4}$ ,  $\frac{55}{7}$ ,  $\frac{67}{15}$ ,  $\frac{41}{8}$ ,  $\frac{59}{8}$ .
11. There are 45 pupils in school and  $\frac{4}{5}$  of them are girls. How many are boys?
12. Add  $8\frac{1}{4}$  and  $7\frac{1}{2}$ .  $5\frac{3}{4}$  and  $7\frac{1}{8}$ .
13. If it takes 5 men 15 days to do a piece of work, how long will it take 10 men to do it?
14. What will 2 bushels of corn cost, if  $\frac{1}{2}$  peck costs 15 cents?
15. If it costs 25 cents to set one shoe, what will it cost to shoe a span of horses all around?
16. Bought 5 yards of ribbon at 16¢, and 3 yards of linen at 75¢, and gave a two-dollar bill. What was my change?
17. If 7 yards cost 84¢, how many yards can be purchased for \$1?
18. If 6 oranges cost 15¢, how much will 8 cost?
19.  $1\frac{1}{2}$  pecks of peanuts cost \$0.48; what will one quart cost?
20. Two boys walked in opposite directions; one walked 5 miles an hour, the other 4 miles an hour. How far apart were they in six hours?
21. If  $\frac{3}{4}$  of a yard of cloth cost 6¢, how much cloth can be bought for 40¢?

22. At  $\frac{1}{2}$  a dollar per day for board, how many days' board can you get for \$7.50?

23. Charles picked  $\frac{1}{2}$  peck of berries, William  $\frac{1}{4}$  peck, and Alfred  $\frac{1}{4}$  peck. How much did they all pick?

24. How much more is  $\frac{3}{4}$  of 80¢ than  $\frac{2}{3}$  of 75¢?

25. A boy bought  $3\frac{1}{2}$  pounds of butter for his mother. How many ounces did he buy?

26. If a man is 50 years old now, how old was he 22 years ago?

27. Mary works 4 hours and 40 minutes, and Nellie works 2 hours and 20 minutes. How many hours do they both work?

28. If you should receive 15 cents at one time, 26 cents at another time, and 14 cents at another time, how much would you receive in all?

29. If you had  $\frac{3}{4}$  of a dollar, and should buy a pound of soda for 8¢ and a pound of tea for 45¢, how much would you have left?

30. If you give a boy \$10, how many mills do you give him?

31.  $50 - 12 - 9 - 19 =$

32.  $72 \div 7$  times 9 = what number?

33. 45 is how much less than 5 times 12?

34.  $(\frac{3}{4} \text{ of } 80) + 25 =$

35.  $(35 + 15) - (14 \div 9) =$

36.  $\frac{5}{8} =$  how many sixths?

37.  $2\frac{1}{2} =$  how many fourths?

38. Give the exact divisors of 20.

40. From  $\frac{2}{3}$  take  $\frac{1}{4}$ .

39. Give the three factors of 30.

41.  $2\frac{1}{2} + \frac{1}{3} - \frac{1}{4} =$

42. At 12 cents a dozen, what will a gross of buttons cost?

43. How many inch cubes will exactly cover a square foot of surface?
44. What does  $\frac{3}{4}$  of anything mean?
45. 1 gallon 2 quarts and 1 gallon 1 quart are how many quarts?
46. If 4 yards of muslin cost 48 cents, how much will one-third of a yard cost?
47. Paid \$4.86 for 6 bushels of rye. What was the price per bushel?
48. Bought 3 dolls at 49 cents each. Total cost?
49. If 12 hats cost \$7, what will be paid for 36 hats?
50. If 2 pounds and 5 ounces butter cost 74 cents, what will be the cost of 3 pounds and 2 ounces?
51. How many bottles holding  $1\frac{1}{2}$  pints will be needed to contain  $2\frac{1}{4}$  gallons?
52. A bag of flour contains  $\frac{1}{3}$  of a barrel of 196 pounds. How many pounds does the bag contain?
53. What will be the cost of a dozen heads of cauliflower at the rate of 2 for 25 cents?
54. Twenty examples are given out. A pupil that correctly answers all receives 100 per cent. What per cent will a pupil receive that solves 16 examples?
55. A woman receives \$40 interest a year. How much does she receive in 3 years and 6 months?
56. A man bought some cows at \$35 each, and the same number at \$45 each. What was the average price?
57. A girl received 100 credits in each of three studies, and 80 credits in the fourth. What was the total number of credits in the four studies? What was her average?
58. A square floor contains 144 square feet. How many feet long and wide is it?



59.  $\frac{3}{4}$  yard cloth costs \$ $\frac{3}{4}$ . What is the price per yard?

NOTE. — In dividing one fraction by another mentally, reduce both to their common denominator.

$\frac{3}{4}$  price of a yard = \$ $\frac{3}{4}$ .  $\frac{1}{12}$  price of a yard = \$ $\frac{1}{12}$ . Multiplying by 12, 8 times price of a yard = \$9.

60. A man owning  $\frac{3}{4}$  of a vessel sells  $\frac{3}{4}$  of his share. What part of the vessel does he then own?

61. A barrel contains 196 pounds of flour; the barrel weighs 24 pounds. What is the weight of both?

62. A family uses  $3\frac{1}{2}$  pounds of sugar per day. How long will  $24\frac{1}{2}$  pounds last?

63. How much will be the cost of 3 pounds of 25-cent coffee and 1 pound butter at 36¢?

64. If  $\frac{3}{4}$  of a pound of candy costs 30¢, what will be the cost of  $\frac{7}{8}$  of a pound?

NOTE. — 6 eighths cost 30¢, what will 7 eighths cost?

65. A tailor has a piece of cloth containing  $2\frac{1}{2}$  yards; he sells  $1\frac{3}{4}$  yards. What part of the piece does he sell?

66. How many quarts in 1 bushel 1 peck and 1 quart?

67. Reduce  $\frac{3}{4}\frac{5}{8}$  to lowest terms.

68.  $24\frac{1}{2}$  yards of cloth are used for 7 coats. How many yards in each coat?

69. If cloves are worth 20¢ per  $\frac{1}{4}$  pound, how much will be paid for 7 ounces?

70. At 3 oranges for 5¢, what will be the cost of  $1\frac{1}{2}$  dozen oranges?

71. My purchase amounts to \$1.29. I give the store-keeper a \$2 bill. How much change do I receive?

72. A bushel of nuts was sold for 5¢ per quart. How much money did it bring?

73. How many days in the summer months, June, July, and August?

74. John had 40 cents. After earning 24 more, he spent his money for marbles at 4 cents each. How many did he buy?

75. George was sent to the store with 50¢. He bought 6 pounds of rhubarb at 2¢ a pound, and two bunches of radishes at 5¢ a bunch. How much money had he left?

76. At \$10 a ton what will be the cost of 1000 pounds?

77. There are 16 rooms in a building with 50 desks in a room. How many desks in all?

78. Edgar earned \$2.75 one week, and \$2.50 the next week. How much did he earn in both weeks?

79. \$6 is  $\frac{3}{4}$  of how many dollars?

80. Charles began work at 2.45 P.M. and stopped at 5.15 P.M. How long did he work?

81.  $29 + 18 + 30 + 9 + 8 + 7 = ?$

82.  $\frac{1}{2}$  of 22 is how many times 4?

83. Bought a horse for \$45 and a saddle for \$35 and then sold them, gaining \$20. For how much were they sold?

84. Add these numbers: 12, 15, 9, 13, 11, 7, and 24.

85. If you buy 6 yards of tape at 7 cents a yard, and 4 yards of silk at 7 dollars a yard, what will you give for both tape and silk?

86. Bought 8 firkins of butter for \$72, and gave 2 of them for 9 yards of cloth. What was a yard of the cloth worth?

87. Mr. Brown mixed 3 pounds of black tea worth 40 cents a pound with 1 pound of 60-cent green tea. What is the mixed tea worth a pound?

**184. Written Review Exercises.**

1. In 6987 days how many minutes?
2. Find the cost of 1,588,000 pounds of coal at \$5.98 a ton.
3. How many cords of wood, at \$7.85 a cord, can be purchased for \$59,730.65?
4. Divide \$3,245,530 by 468.
5. Bought 8 bushels 3 quarts valuable seed at seven dollars and eight cents a quart. How much did the seed cost?
6. What is the cost of 19 gallons 2 quarts of cologne at 90¢ a quart?
7. Divide  $\frac{1}{4}$  of \$60,800 equally among 75 persons.
8. Bought a house for \$23,650, and land for \$73,640. For how much must I sell them to gain \$4500?
9. Find the greatest common divisor of 45 and 135.
10. A grocer bought 7200 gallons of oil, one-third of it leaked out, and he sold the remainder at 25 cents a gallon. How much did he receive for it?
11. From two and four-tenths yards take .445 of a yard.
12. Add the numbers from 490 to 505 (inclusive).
13. If 56 pounds of sugar cost \$3.08, what will 24 pounds cost?
14. If 42 gallons 3 quarts 1 pint of cream cost \$27.44, what will 32 pints cost?
15. A man's bill at a provision store was \$6.66. He had bought two pecks of peas for \$0.54 and some beans for \$0.36. The rest of the bill was for sirloin steak at \$0.32 per pound. How many pounds of meat had he bought?
16. From 1,890,070 take 990,979.
17. If a train travels 45 miles per hour, how far will it go from half-past 9 in the morning to a quarter of 7 in the evening?

18. A mechanic saved \$35 per month for 11 months, and \$20 the twelfth month. His expenses averaged \$3 each day of the year. What were his daily wages for the 300 days he worked?

19. A 160-acre farm consists of 5 fields. The first contains 17.38 acres, the second 29.4 acres, the third 35.073 acres, the fourth 25.875 acres. How many acres are there in the fifth field?

20. How many seconds in 7 hours 15 minutes?

21. Find the total cost of 2 dozen rockets at \$7.50 per gross, 3 dozen Roman candles at \$9.60 per gross, and 24 dozen pinwheels at \$1.35 per gross.

(1 gross = 12 dozen.)

22. Three lots of tea were sold for \$330. The second contained twice as much as the first, and the third three times as much as the first. The third lot contained 330 pounds. Find the selling price of the tea per pound.

23. A barrel of molasses contained 40 gallons. One-fourth of it leaked out. If the molasses cost 45 cents per gallon, what price must be charged for the remainder so that there will be no loss?

24. If  $12\frac{1}{2}$  dozen rockets cost \$5.75, what will 15 dozen cost?

25. Show by drawings that  $\frac{1}{3} = \frac{4}{12}$ , and that  $\frac{2}{3} = \frac{8}{12}$ .

26. Write the first five prime numbers that are greater than 7.

27. Find the greatest common divisor of 1220 and 2013.

28. Find the least common multiple of 12, 15, 14, 6, 21, 21, and 24.

29. Find the prime factors of 1140.

30. Add  $3\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{5}{7}$ , and  $\frac{2}{3}$  of  $7\frac{1}{2}$ .

31. From  $14\frac{7}{8}$  pounds of butter,  $5\frac{3}{4}$  pounds were sold to one person and  $3\frac{1}{4}$  to another. How much remained?

32. A man bought 4 bushels of wheat for  $3\frac{1}{4}$  dollars. What fraction of a dollar did one bushel cost?

33. If  $\frac{3}{8}$  of a bushel of oats will last a horse one day, how long will  $4\frac{1}{2}$  bushels last?

34. In two months Ann will be 15 years old. How old was she nine months ago?

35. A boy has to walk from his home to a house  $1\frac{1}{4}$  miles east of his home, from there to a place  $2\frac{1}{2}$  miles west of his home, and then home. How far has he to walk?

36. I lost  $\frac{4}{5}$  of my money, then found  $\frac{2}{3}$  of what I had lost, and then had 64 cents. How much had I at first?

37. Quotient  $24\frac{1}{2}$ , divisor  $3\frac{1}{4}$ . What is the dividend? The product is  $2\frac{3}{8}$ , and one factor is  $\frac{2}{3}$ . What is the other factor?

38. Bought  $3\frac{1}{4}$  yards of muslin at 7 cents a yard,  $5\frac{1}{2}$  yards of ribbon at  $3\frac{1}{2}$  cents a yard, and  $2\frac{1}{8}$  yards of cloth at \$1.75 per yard, and gave a ten-dollar note in payment. How much change did I receive?

39. Write seven million nine thousand nineteen.

40. A milliner sells 3 pieces of ribbon at 18 cents per yard. They measure  $4\frac{3}{8}$  yards,  $3\frac{1}{8}$  yards, and  $5\frac{5}{8}$  yards respectively. What does she receive for the ribbon?

41. How many feet and inches in  $\frac{5}{12}$  of a yard?

42. To make powder, a man mixes  $7\frac{1}{4}$  pounds of saltpetre,  $1\frac{7}{8}$  pounds of sulphur, and as much charcoal as sulphur. How many pounds of powder will there be?

43. Four men form a partnership; the first furnishes  $\frac{1}{5}$  of the capital, the second  $\frac{3}{8}$ , and the third  $\frac{5}{12}$ . What fraction of the capital is furnished by the fourth?

44. I pay 15 cents more for a half-pound of tea than I pay for a quarter-pound of the same tea. What is its price per pound?

45. After doing  $\frac{3}{4}$  of a piece of work, a man requires 3 days more to finish it. How many hours does he take to do the whole work if he works 8 hours per day?

46. If 1 pound 7 ounces of coffee cost 46 cents, what will 3 pounds 9 ounces cost?

47. Add 6 hours 50 minutes and 17 hours 10 minutes.

48. 15 men do a piece of work in  $10\frac{3}{4}$  days. How long would it take 5 men to do the same work?

49. To make a cloak, 3 yards of cloth  $1\frac{1}{2}$  yards wide are required. How much cloth  $\frac{3}{4}$  yard wide would be required?

50. In 3 years 4 months a gas company manufactures 4,200,000 cubic feet of gas. How many cubic feet are manufactured per year?

51. If  $2\frac{3}{4}$  dozen hats cost \$80, what will be the cost of 3 hats?

52. A boy hires a boat at 20 cents per hour. How much should he pay if he uses it from 20 minutes before 9 A.M. until 10 minutes past 1 P.M.?

53. A and B kill an ox. A takes  $\frac{5}{8}$  and B the remainder. If B's share weighs  $361\frac{1}{2}$  pounds, what is the weight of the ox?

54. A grocer buys 30 dozen eggs at 18 cents per dozen. He sells them at the rate of 15 eggs for 25 cents. What is his profit?

55. How many cents in  $\frac{5}{16}$  of a dollar?

56. What fraction of  $18\frac{3}{4}$  is  $6\frac{3}{4}$ ?

SUGGESTION.—What fraction of 18 is 6? Which is the divisor?

57. A farmer buys a horse for \$140, and sells it at an advance of  $\frac{3}{20}$  of the cost. What is the selling price?

58. In 1903, A was 36 years old and B was  $1\frac{3}{4}$  times as old. In 1894, B was how many times as old as A?

59. From the sum of  $18\frac{7}{10}$  and  $25\frac{1}{2}$  take their difference.

60. If  $2\frac{1}{2}$  acres of land cost \$220, what will be the cost of  $17\frac{1}{2}$  acres?

NOTE.—Indicate the operations, and cancel.

61. A can do a piece of work in 6 days, B can do it in 6 days, C can do it in 6 days. How long will it take all three working together?

62. Find the value of  $\frac{\frac{2}{3} \text{ of } \frac{3}{4} \text{ of } 2\frac{1}{2}}{\frac{1}{2} \text{ of } 3\frac{3}{4}}$ .

63. A man sold a horse for  $\frac{3}{4}$  of its cost, losing \$40. What did the horse cost him?

64. I have an oblong piece of land which is 96 feet long and 72 feet wide. There are three gateways; one is two feet wide, one is three feet wide, and the other is four feet wide. How many feet of fence will it take to go around the field?

65. Add: \$83.34; \$67.58; \$50.37; \$62.50; \$35.75; \$62.50; \$35.75; \$63.81; \$67.59; \$86.37; \$37.50; \$15.09; \$57.32; \$49.63.

*(Used to read) \$51*  
 \$10.50 66. A boy bought a suit of clothes for \$21, boots for \$3.50, overcoat for \$15, and gloves for 50¢. Paid for these things in work at \$1.25 per day. How many days did he work?

67. If \$36.53 will buy  $6\frac{1}{2}$  yards of cloth, how much will  $\frac{1}{4}$  yard cost?

68. If two quarts of peaches cost 25¢, what will half a bushel cost?

69. How many geographies at 90¢ apiece can be bought for \$54?

70. Find the least common multiple of 6, 24, 32, 48, 96.

71. Add: 87.5; 7004.3; 500.004; 21,090; 5040.29.

72. Spent \$290 for horses, \$286.75 for carriages, \$150.80 for harness, and \$12.75 for blankets. Gave 4 fifty-dollar bills and 2 one-hundred-dollar bills. What did I still owe?

73. How many bushels of oats will a span of horses eat in 4 weeks, if they eat 24 quarts a day?

74. How many bottles, each holding  $\frac{1}{2}$  pint, will it take to hold 725 gallons and 2 quarts of oil?

75. How many pounds of rice at 12¢ a pound, will pay for 4 bushels 2 pecks of nuts at 8¢ a pint?

76. A man had \$600. He bought a horse for \$225, a carriage for \$190.12, and a harness for \$40.76. He then gave away  $\frac{1}{2}$  of what he had left. What did he still have?

77. Find the greatest common divisor of 18, 24, 36.

78. The least common multiple of 12, 20, and 30.

79. Find the cost of 18,756 feet of lumber at \$30 per 1000 ft.

80. A field is 14.25 rods long by 7.4 rods wide. What is its area in square rods?

81. A rod is 16.5 feet; how many feet are there in 24 rods? How many rods are there in 231 feet?

82. How many marks are there in \$100? (A mark is equal to 23.8 cents.)

83. Add 3 and 4 tenths, 96 thousandths, 100 and 5 thousandths, 27 hundredths.

84. From 2700 take 27 hundredths.

85. Multiply 8 and 4 tenths by 9 and 25 hundredths.

86. Divide 96 and 75 hundredths by 322 and 5 tenths.

87. A load of hay, at 75 cents per 100 pounds, cost \$13.98. What was the weight of the hay?



88. The circumference of a circle is 3.1416 times the diameter. How many inches in the circumference of a circle whose diameter is 20 inches?

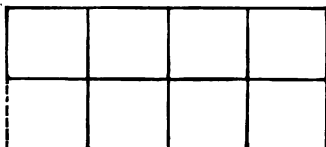
89. Show by a diagram the number of pieces of wire  $\frac{3}{4}$  yard long that can be made from 4 yards of wire.

90. Show by a diagram that three-fourths of 1 is equal to one-fourth of 3.

91. If two-thirds of a yard of material will make an apron, how many aprons can be made from two yards? Show by a diagram.

92. A boy paid 6 cents for three-eighths of a pie. What would be the cost of the whole pie at the same rate? Make a drawing.

93. Seven-eighths of an acre of land is sold for \$140. What is the price of an acre?



## CHAPTER III.

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### DECIMALS.

#### 185. Preliminary Exercises.

1. Write seven tenths as a common fraction. As a decimal.
  
2. Write three hundredths as a common fraction. As a decimal.
  
3. Write thirty-one thousandths as a common fraction. As a decimal.

4. Read the following:

.3	.09	.043
.17	.007	.241

5. Write each of the foregoing decimals as a common fraction.

### 186. Notation and Numeration of Decimals.

1. 7 tenths, or  $\frac{7}{10}$ , is written .7.
2. 3 hundredths, or  $\frac{3}{100}$ , is written .03.
3. 53 hundredths, or  $\frac{53}{100}$ , is written .53.
4. 9 thousandths, or  $\frac{9}{1000}$ , is written .009.
5. 19 thousandths, or  $\frac{19}{1000}$ , is written .019.
6. 419 thousandths, or  $\frac{419}{1000}$ , is written .419.
7. 67 ten-thousandths, or  $\frac{67}{10000}$ , is written .0067.
8. 1031 hundred-thousandths, or  $\frac{1031}{100000}$ , is written .01031.

NOTE. — In the foregoing examples, it will be observed that the number of places to the right of the decimal point is equal to the number of ciphers in the denominator of the corresponding common fraction.

187. Write the following as decimals:

1. 314 ten-thousandths.

Since  $\frac{314}{10000}$  has a denominator containing four ciphers, the decimal must have four places; a decimal cipher must be written after the decimal point.

Ans. .0314.

*To write a decimal, write the numerator, and from the right, point off as many decimal places as there are ciphers in the denominator, prefixing decimal ciphers, if necessary.*

NOTE. — Ciphers between the decimal point and the first significant figure of the numerator are called *decimal ciphers*.

2. 217 hundred-thousandths.

3. 83 hundredths.

4. 7 millionths.

5. 345 thousandths.

6. 27 ten-thousandths.

7. 325 and 7 thousandths.

*Ans.* 325.007. This is called a *mixed decimal*, which consists of an integer and a decimal.

188. The word *and* is used in reading mixed numbers or mixed decimals to separate the integer from the common fraction or the decimal.

8. 42 and 56 hundred-thousandths.

9. 150 and 62 millionths.

10. 489 and 3 hundredths.

189. Read the following:

1. .0346.

Since there are four decimal places, the denominator is 1 with four ciphers, 10000.

*Ans.* 346 ten-thousandths.

2. 654.15

6. 25.006347

3. .000209

7. 3.259

4. 60.0207

8. .002468

5. 684.007

9. 200.0035

200.0035 read as 200 and 35 ten-thousandths might be mistaken for 235 ten-thousandths. It should be read 200 units and 35 ten-thousandths, or 200 whole number and 35 ten-thousandths.

10. 1000.0006

12. 2300.00021

11. 300.075

13. 400.000007

**190. Changing Common Fractions to Decimals.**Reduce  $\frac{3}{32}$  to a decimal.

$\frac{3}{32}$  means 3 ÷ 32. Performing the indicated division, we obtain the quotient .09375.  $\frac{3}{32} = .09375$ , Ans.

$$\begin{array}{r}
 .09375 \\
 32 \overline{) 3.00000} \\
 \underline{288} \phantom{00} \\
 120 \phantom{00} \\
 \underline{96} \phantom{00} \\
 240 \phantom{00} \\
 \underline{224} \phantom{00} \\
 160 \phantom{00} \\
 \underline{160} \\
 0
 \end{array}$$

*Divide the numerator, with the necessary ciphers annexed, by the denominator. The number of decimal places in the quotient will be equal to the number in the dividend.*

Reduce to decimals:

1.  $\frac{1}{800}$

8.  $\frac{1}{82}$

15.  $\frac{11}{250}$

2.  $\frac{1}{40}$

9.  $\frac{21}{4000}$

16.  $\frac{1}{825}$

3.  $\frac{2}{25}$

10.  $\frac{7}{2000}$

17.  $\frac{375}{64}$

4.  $\frac{25}{82}$

11.  $\frac{18}{78}$

18.  $\frac{18}{128}$

5.  $\frac{17}{84}$

12.  $\frac{7}{128}$

19.  $\frac{1}{258}$

6.  $\frac{3}{18}$

13.  $\frac{28}{8}$

20.  $\frac{57}{12}$

7.  $\frac{8}{500}$

14.  $\frac{47}{16}$

21.  $\frac{1}{1024}$

**191. Changing Decimals to Common Fractions.**

What is the denominator of a decimal fraction?

What prime numbers are contained in 10? What are the only factors of 10? The prime factors of 100? Of 1000?

Can  $\frac{7}{1000}$  be reduced to lower terms? Why? Can  $\frac{8}{100}$  be reduced to lower terms? Why? Can  $\frac{485}{1000}$  be reduced to lower terms? How can we tell by merely looking at a decimal whether or not it can be reduced to a common fraction of lower terms?

**192. Written Exercises.**

Reduce the following to common fractions — lowest terms. Do not find the greatest common divisor.

1. Reduce .0064 to a common fraction — lowest terms.

$$.0064 = \frac{64}{10000} = \frac{16}{2500} = \frac{4}{625}, \text{ Ans.}$$

2. Reduce .039 to a common fraction.

$$.039 = \frac{39}{1000}, \text{ Ans.}$$

This cannot be reduced to lower terms, since 39 is not divisible by 2 or 5.

3. Reduce .900 to a common fraction — lowest terms.

$$\frac{900}{1000} = \frac{90}{100} = \frac{9}{10}, \text{ Ans.}$$

*Omit the decimal point. Write in the form of a common fraction, and reduce to lowest terms.*

Ciphers at the right of a decimal cancel ciphers in the denominator; they do not, therefore, affect the value of the decimal, and they should be omitted.

193. Reduce to common fractions:

- |           |            |            |
|-----------|------------|------------|
| 1. .0075  | 8. .37500  | 15. .0009  |
| 2. .36    | 9. .144    | 16. .816   |
| 3. .0275  | 10. .0006  | 17. .15625 |
| 4. .44    | 11. .27    | 18. .0375  |
| 5. .03125 | 12. .027   | 19. .00625 |
| 6. .486   | 13. .00365 | 20. .096   |
| 7. .3750  | 14. .96    | 21. .326   |

#### ADDITION OF DECIMALS.

194. Add the following, reducing the common fractions to decimals.

$$1. \ 18\frac{1}{4} + 9.084 + 25\frac{1}{20} + 163 + 2.09 + .0975$$

$$\begin{array}{r}
 18.75 \\
 9.084 \\
 25.05 \\
 163. \\
 2.09 \\
 \hline
 .0975 \\
 \hline
 \end{array}$$

Write the decimals so that tenths, hundredths, etc., stand in the same column, etc.

*Write the numbers so that decimal points stand in a column. Add as in integers, and place the point in the sum directly under the points above.*

2.  $275\frac{8}{100} + 58.64 + 8.6796 + 30\frac{1}{2} + 8\frac{3}{4} + 99$
3.  $84\frac{7}{10} + 93\frac{8}{100} + 3\frac{141}{1000} + 1\frac{218}{1000} + 684.1 + \frac{1}{2}$
4.  $250 + 1875.93 + 16\frac{3}{4} + \frac{2}{3} + 608.94 + .0005$
5.  $8.6796 + 96.8 + 18\frac{3}{4} + 34\frac{1}{10} + 1876$
6.  $40\frac{3}{5} + 7.2832 + 86.3 + 128.46 + 2\frac{1}{5}$
7.  $540 + 1.32 + .576 + 1\frac{22}{10000} + 68\frac{5}{10} + 395\frac{1}{2}$
8.  $5.308 + .25 + 567.8 + 8.4825 + 49.795 + 8\frac{3}{4}$
9.  $7.08 + 23.04 + 8\frac{7}{10} + .348 + 3\frac{1}{5} + 7.00019$
10.  $8\frac{222}{1000} + 8\frac{1}{2} + 507 + 28\frac{42}{100} + 6.8819$

### SUBTRACTION OF DECIMALS.

195. Give answers in decimals:

1.  $275.3 - 87\frac{3}{10}$

Arrange the decimals as in addition, tenths under tenths, etc.

$$\begin{array}{r} 275.3 \\ 87.04 \\ \hline 188.26 \text{ Ans.} \end{array}$$

*Write the numbers so that the decimal point of the subtrahend is directly under the decimal point of the minuend; subtract as in integers, and place the point in the remainder directly under the points above.*

2.  $387\frac{3}{4} - 99.0127$

7.  $2345 - 345\frac{1}{2}$

3.  $1000 - 1\frac{1}{1000}$

8.  $168\frac{3}{10} - 54.8759$

4.  $62.365 - 48\frac{1}{4}$

9.  $618.42 - 576\frac{1}{4}$

5.  $198\frac{3}{4} - 13.6431$

10.  $1847\frac{1}{10} - 344\frac{8}{100}$

6.  $24\frac{3}{10} - 9\frac{22}{1000}$

11.  $622.5 - 6.243$

**196. Oral Problems.**

1. Reduce  $\frac{1}{8}$  to a decimal.
2. Express the decimal  $.3\frac{1}{2}$  as a simple fraction.
3. What decimal of a ton is 125 pounds?
4. One hundred fifty marbles are divided among a certain number of boys. Each receives 12 and there are 6 remaining. How many boys are there?
5. Express the decimal  $.62\frac{1}{2}$  as a simple fraction.
6. What decimal of a peck is 7 quarts?
7. If 8 men can do a piece of work in 6 days, in how many days can 4 men do it?
8. If Maria spends \$.75 a day, in how many days will she spend \$9?
9. If you had  $3\frac{1}{2}$  oranges to divide among your friends, giving each  $\frac{1}{4}$  of an orange, to how many friends would you give?
10.  $\frac{1}{2}$  of 14 is  $\frac{1}{4}$  of what number?
11. Change .75 yards to feet and inches.
12. At  $16\frac{2}{3}$ ¢ a yard, what will 12 yards of ribbon cost?
13. At 80¢ a pound, what do 4 ounces of tea cost?
14. If I have 12 yards of ribbon, to how many girls can I give  $\frac{3}{4}$  of a yard each?
15. A boy lives  $10\frac{1}{2}$  rods from his school. How far does he walk in a day to attend two sessions of school?

**197. Written Problems.**

1. In the written number 54,372, the value expressed by the 5 is how many times the value expressed by the 2?
2. Find the sum of two and twenty-five thousandths, five and twenty-seven ten-thousandths, forty-seven and one hundred twenty-six millionths, one hundred fifty and seven ten-millionths.



3. In a mass of alloy weighing 291.42685 pounds, there were found 40.0921 pounds of silver, 160.09090 pounds of copper, 22.002 pounds of iron, and .426900 pounds of zinc. The remainder was lead. What was the weight of the lead?

4. How many bushels of oats at  $\frac{3}{4}$  of a dollar a bushel will pay for  $\frac{3}{4}$  of a barrel of flour at \$5.40 a barrel?

5. Add 3.684; 19.5; .00875; 15,863.625; 8.7; and 100.4875.

6. Change to a common fraction in its lowest terms .009375. Change  $\frac{3}{4}$  to a decimal.

7. If  $\frac{3}{4}$  pound of tea costs \$ $\frac{1}{2}$ , how many pounds can be bought for \$7.50?

8. Change to common fractions .0075 and .625.

9. Change to decimals  $\frac{5}{16}$ ,  $\frac{9}{16}$ , and  $5\frac{1}{8}$ , and add the results.

10. Reduce to common fractions, and then find the sum of the common fractions:  $.12\frac{1}{2}$ ,  $.3\frac{1}{2}$ ,  $.16\frac{3}{4}$ .

11. Add three hundred seventy-six ten-thousandths, forty-five hundred-thousandths, five hundred sixty-eight thousandths, fourteen and fifteen hundredths.

12. At 24 cents per gallon, what will be the cost of 16 gal. 3 qt. of milk?

### MULTIPLICATION OF DECIMALS.

198. Give answers in decimals:

1. Multiply .000486 by 29.5.

Place the units' figure (9) of the multiplier under the last figure (6) of the multiplicand. 486 millionths multiplied by 2 tens gives a product of 972 hundred-thousandths, or .00972; place the right-hand figure (2) of this product under the 2 of the multiplier, etc.

The result, .0143370, contains seven decimal places, which is equal to the six in the multiplicand plus the one in the multiplier. Rejecting the unnecessary cipher at the right, the product is .014337, *Ans.*

$$\begin{array}{r}
 .000486 \\
 \times 29.5 \\
 \hline
 .00972 \\
 4374 \\
 \hline
 2430 \\
 \hline
 .0143370
 \end{array}$$

2. Multiply 29.5 by .000486.

$$\begin{array}{r}
 29.5 \\
 \times .000486 \\
 \hline
 .01180 \\
 2360 \\
 1770 \\
 \hline
 .0143370
 \end{array}$$

The units' figure of the multiplier may be considered as zero.

Ans. .014337.

*Multiply as in whole numbers, and from the right of the product point off as many decimal places as there are decimal places in both factors.*

Multiply:

1.  $24.75 \times 3.02$

6.  $1.876 \times 3\frac{1}{2}$

2.  $98\frac{3}{4} \times .00046$

7.  $3.48 \times 4.8665$

3.  $148\frac{1}{10} \times 12.5$

8.  $.43\frac{1}{4} \times 1\frac{1}{8}$

4.  $380\frac{1}{2} \times .012$

9.  $192.38 \times .238$

5.  $.09375 \times 1.48$

10.  $26.4 \times .016$

## DIVISION OF DECIMALS.

199. 1. Divide 7.345 by .29.

$$\begin{array}{r}
 25.327 \\
 29 \overline{) 7.34.500} \\
 \underline{58} \phantom{00} \\
 154 \phantom{00} \\
 \underline{145} \phantom{00} \\
 95 \phantom{00} \\
 \underline{87} \phantom{00} \\
 80 \phantom{00} \\
 \underline{58} \phantom{00} \\
 220 \phantom{00} \\
 \underline{203} \phantom{00} \\
 17
 \end{array}$$

Make the divisor a whole number by moving the decimal point two places to the right, which multiplies the divisor by 100; and make a corresponding change in the dividend. Dividing 734.5 by 29 gives a quotient of 25.3275+. Since the quotient is to be limited to three decimal places, 8 followed by a minus sign is substituted for the 7, to indicate that the fourth decimal figure is at least 5.

Ans. 25.328 -

2. Divide 753 by 4.18.

Removing the decimal point in the divisor two places to the right multiplies the divisor by 100. Annex two ciphers to the dividend.

As the fourth decimal figure in the quotient is greater than 5, the 8 is changed to a 4, followed by a minus sign.

*Ans.* 180.144 -

$$\begin{array}{r}
 180.143 \\
 4 \overline{) 18.75300.000} \\
 \underline{418} \phantom{00} \\
 3350 \phantom{00} \\
 \underline{3344} \phantom{00} \\
 60.0 \phantom{00} \\
 \underline{41.8} \phantom{00} \\
 18.20 \phantom{00} \\
 \underline{16.72} \phantom{00} \\
 1.480 \phantom{00} \\
 \underline{1.254} \phantom{00} \\
 226
 \end{array}$$

3. Divide .8756 by 4326.

The decimal point in the quotient is placed over the new decimal point in the dividend, the necessary decimal ciphers being supplied. A + sign is placed after the last quotient figure to show that the next quotient figure is less than 5.

$$\begin{array}{r}
 \text{Ans. } .0002024 + \\
 4326 \overline{) .8756000} \\
 \underline{8652} \phantom{00} \\
 10400 \phantom{00} \\
 \underline{8652} \phantom{00} \\
 17480 \phantom{00} \\
 \underline{17304} \phantom{00} \\
 176
 \end{array}$$

*Make the divisor a whole number by removing the decimal point, and make a corresponding change in the dividend. The number of decimal places in the quotient will be equal to the number in the dividend as changed.*

## 200. Written Exercises.

Divide:

1.  $4.054 \div 18.25$
2.  $123.5 \div 384$
3.  $471 \div 5.325$
4.  $.3126 \div .0134$
5.  $12.345 \div .0047$
6.  $.8756 \div 4.322$
7.  $8 \div 122$
8.  $.3678 \div .9125$
9.  $48.45 \div .089$

10.  $62.478 \div 4279$
11.  $346.25 \div 64.8$
12.  $9.1342 \div 208.3$
13.  $1784 \div 29.57$
14.  $343.71 \div 1.127$
15.  $83.087 \div 5.37$
16.  $137.84 \div 7.91$
17.  $38.9008 \div .523$
18.  $.81074 \div .0091$

201. Solve by short division:

1. Divide 18.756 by 3000.

Cancel the ciphers in the divisor, thereby dividing it by 1000. Move the decimal point in the dividend three places to the left, which divides it by 1000. Place the decimal point in the quotient under the new decimal point in the dividend.

$$\begin{array}{r} 3000 \overline{) 0.018756} \\ \underline{.006252} \text{ Ans.} \end{array}$$

- |                       |                          |
|-----------------------|--------------------------|
| 2. $48.36 \div 4000$  | 11. $48.64 \div 200$     |
| 3. $.4824 \div 12000$ | 12. $.00531 \div 90000$  |
| 4. $11.011 \div 700$  | 13. $96.51 \div 60$      |
| 5. $3.6504 \div 90$   | 14. $87.5 \div 500$      |
| 6. $45.63 \div 1500$  | 15. $183.275 \div 10000$ |
| 7. $130.13 \div 1100$ | 16. $1.7632 \div 1600$   |
| 8. $.8712 \div 60$    | 17. $1.5639 \div 130$    |
| 9. $3.075 \div 5000$  | 18. $614.4 \div 120$     |
| 10. $.07056 \div 140$ | 19. $.8008 \div 7000$    |

202. Perform indicated operations.

Change the divisor to a whole number, making corresponding change in the dividend. Cancel.

$$1. \quad \frac{34.2 \times \overset{7}{\cancel{875}}}{\cancel{125}} = 239.4$$

$$5. \quad \frac{234 \quad .001}{\cancel{9876} \times \cancel{.182}} = .234$$

$$\frac{7278}{4}$$

$$2. \quad \frac{.249 \times 3.92}{.098}$$

$$6. \quad \frac{3.1416 \times 2.3}{.7854}$$

$$3. \quad \frac{.083 \times .72}{288}$$

$$7. \quad \frac{7.72 \times 65}{19.3}$$

$$4. \quad \frac{.6876 \times .27}{.081}$$

$$8. \quad \frac{450 \times 23.8}{1.19}$$

9.  $\frac{34.3 \times 8.1}{.49 \times 100}$       11.  $\frac{2.75 \times .801}{1.1 \times 6}$
10.  $\frac{.576 \times 6.3}{14.4 \times 25}$       12.  $\frac{.306 \times 8.75}{.9 \times 68}$

203. Reduce to common fractions—lowest terms.

1. Reduce  $.3\frac{1}{2}$  to a common fraction—lowest terms.

$.3\frac{1}{2}$  is a complex decimal; that is, a decimal and a common fraction written together. It may be written as the complex fraction  $\frac{3\frac{1}{2}}{10}$ , which means  $3\frac{1}{2} \div 10$ .

$$3\frac{1}{2} \div 10 = \frac{1^2}{2} \times \frac{1}{10} = \frac{1}{20}, \text{ Ans.}$$

NOTE.—A complex fraction is one which has a fraction in the numerator or in the denominator or in both.

2. Reduce  $.006\frac{1}{2}$  to a common fraction—lowest terms.

$$.006\frac{1}{2} = .00625 = \frac{625}{100000};$$

dividing both terms by 25, we get  $\frac{25}{4000}$ ;

dividing both terms by 25, we get  $\frac{1}{160}$ , Ans.

- |                      |                      |                       |
|----------------------|----------------------|-----------------------|
| 3. $.33\frac{1}{2}$  | 6. $.01\frac{1}{2}$  | 9. $.04\frac{1}{2}$   |
| 4. $.16\frac{1}{2}$  | 7. $.06\frac{1}{2}$  | 10. $.76\frac{1}{2}$  |
| 5. $.142\frac{1}{2}$ | 8. $.833\frac{1}{2}$ | 11. $.037\frac{1}{2}$ |

204. Oral Exercises.

- Divide 6 by .03.
- $\frac{3}{4}$  is what part of 2?
- What is the product of one hundred by one-hundredth?
- Subtract 25 thousandths from 5.
- What will 150 pounds of coffee cost at the rate of 3 pounds for 50 cents?
- What will be the cost of 3 pecks of cherries at 2 cents a pint?

7. Divide  $\frac{3}{4}$  by  $\frac{1}{4}$ .

8. At 3 oranges for 5 cents, what will be the cost of 4 dozen oranges?

9. If a man walks  $\frac{7}{12}$  of a mile in 10 minutes, how far can he walk in an hour and a half?

10. A woman bought 12 yards of cloth at 70¢ a yard; she paid \$5 in cash, and the rest in butter at 20¢ a pound. How many pounds of butter did she give?

### 205. Written Exercises.

1. Divide the sum of .736 and 1.2854 by their difference.

2. Divide .1 by .2, and .35 by 35, and find the product of the quotients.

3. Reduce  $\frac{7}{1120}$  to a decimal, and divide it by .3125.

4. Divide .12096 by .032.

5. Multiply .00273 by 3000.456, and divide the product by .08.

6. Divide 12.3125 by .000625.

7. Divide 51.5 by 412, and 412 by 51.5.

8. Multiply 31.5 by 27.9, and divide the product by 9.765.

9. Reduce  $\frac{4.25}{3 + \frac{1}{8}}$ .

10. Find the value of  $\frac{.0021 \times 3.004}{.024}$ .

11. What will be the duty on 175 kilograms of wool at 33 cents per pound? (1 kilogram = 2.2046 pounds.)

12. How much is the fraction  $\frac{3}{4}$  increased or diminished when 2 is added to each of its terms (numerator and denominator)?

13. Find the cost of 360 meters of cloth at \$1.10 per yard (1 meter = 39.37 inches).

14. Find the cost in United States money of 386 hats at 24 francs each (1 franc = 19.3 cents).

15. Find the cost in United States money of 480 meters of cloth at 1.10 marks per meter (1 mark = 23.8 cents).

16. A merchant bought 30 pieces of cloth, each containing 41.6 yards, for \$3.875 per yard, and 25 pieces of 36.8 yards each, for \$4.125 per yard. He sold the entire lot for \$3.96 per yard. How much did he gain or lose?

17. An importer received a box of chemicals weighing 122 grams, each gram containing 15.432 English grains, on which he paid a duty of \$.05 per grain. What was the amount of duty?

18. A dealer exported 374.319 bushels of corn, receiving in exchange coal at the rate of 1 ton of coal for 15.124 bushels of corn. How much coal did he receive?

19. .75 is what part of 3.25?

20. Reduce .005025 to a common fraction.

#### UNITED STATES MONEY.

##### 206. Written Exercises.

1. Find the cost of 24,400 bricks @ \$6.25 per M.

M means 1000.  $24,400 = 24.4$  M. Since the cost per thousand is \$6.25, 24.4 thousand will cost 24.4 times \$6.25.

2. 760 pounds of hay @ 95 cents per cwt. (100 pounds)  
( $\$.95 \times 7.6$ )

3. 48,600 laths @ \$2.80 per M.

4. 39,250 stamped envelopes @ \$21.30 per thousand.

5. 1875 pounds of straw @ 68 cents per cwt.

6. 108,745 Philadelphia bricks @ \$22 per M.
7. 14,860 oranges @ 75¢ per hundred.
8. 2376 eggs @ 13¼¢ per dozen.
9. 4500 cigars @ \$35 per M.
10. 28 dozen wax candles @ \$13.50 per gross (144).

Solve by cancellation where possible :

11. 38,648 pounds of wheat @ 90¢ per bushel (60 pounds).

Since there are 60 pounds in a bushel, 38,648 pounds =  $\frac{38648}{60}$  bushels. At 90 cents per bushel, the cost is  $\frac{\$.09 \times 38648}{60}$ , etc.

NOTE. — In cancelling, be careful not to strike out a cipher in 60 and one in .90, without inserting a decimal cipher.

12. 18,964 pounds of coal @ \$5 per ton (2000 pounds).
13. 48,576 pounds of oats @ 36¢ per bushel (32 pounds).
14. 69,104 pounds of rye @ 91½¢ per bushel (56 pounds).
15. 74,816 pounds of corn @ 48¼¢ per bushel (56 pounds).

## DENOMINATE NUMBERS.

### 207. Written Exercises.

1. Change 12 pounds and 9 ounces to ounces.

Since there are 16 ounces in 1 pound, in 12 pounds there are 12 times 16 ounces, or 192 ounces. In 12 pounds 9 ounces, there are 192 ounces + 9 ounces, or 201 ounces.

The work may be arranged in this way. Above the ounces, write the number of ounces in a pound, viz. 16. Multiply 16 ounces by 12, adding in the 9 ounces.

$$\begin{array}{r} 16 \text{ oz.} \\ 12 \text{ lb. } 9 \text{ oz.} \\ \hline 201 \text{ oz.} \end{array}$$

Ans. 201 oz.



Change:

1. 20 rods and 3 yards to yards.
2. 2 miles to yards.
3. 3 days and 17 hours to hours.
4. 24 minutes and 15 seconds to seconds.
5. 8 tons and 1675 pounds to pounds.
6. 43 gallons and 8 quarts to quarts.
7. 75 gallons to pints.
8. 19 bushels and 3 pecks to pecks.
9. .03125 ton to pounds and ounces.
10.  $\frac{7}{8}$  yard to feet and inches.

**208. Written Exercises.**

Change:

1. 975 ounces to pounds and ounces.
2. 396 inches to yards.
3. 517 hours to days and hours.
4. 1694 seconds to minutes and seconds.
5. 9314 pounds to tons and pounds.
6. 987 pints to gallons, quarts, and pints.
7. 1485 quarts to pecks and quarts.
8. 185 pecks to bushels and pecks.
9. 840 hours to weeks.
10. 12 hours to the fraction of a week.
11. 28 inches to the fraction of a yard.
12. 10 ounces to the decimal of a pound.
13. 3 quarts to the decimal of a bushel.

## 209. Written Exercises.

Add:

1. 13 lb. 6 oz.      10 oz. + 9 oz. + 6 oz. = 25 oz. = 1 lb. 9 oz.  
      5 lb. 9 oz.      Write 9 ounces and carry 1 to column of  
      25 lb. 10 oz.      pounds.      *Ans.* 44 lb. 9 oz.

2. 19 yd. 1 ft.      6. 11 bu. 3 pk.  
      2 ft.      6 bu. 2 pk.  
      3 yd. 1 ft.      2 pk.

3. 5 min. 30 sec.      7. 1 pk. 6 qt.  
      11 min. 25 sec.      1 pk. 7 qt.  
      9 min. 18 sec.      5 qt.

4. 4 ft. 9 in.      8. 3 wk. 5 da.  
      2 ft. 6 in.      6 wk. 6 da.  
      7 ft. 7 in.      1 wk. 3 da.

5. 18 gal. 3 qt.      9. 11 T. 165 lb.  
      9 gal. 1 qt.      4 T. 983 lb.  
      2 qt.      1756 lb.

## 210. Subtract:

1. 8 lb.      Change 8 lb. to 7 lb. 16 oz.  
      4 lb. 7 oz.      16 oz. - 7 oz. = 9 oz.  
      7 lb. - 4 lb. = 3 lb.      *Ans.* 3 lb. 9 oz.

2. 15 yd. 1 ft.      6. 89 bu. 2 pk.  
      9 yd. 2 ft.      67 bu. 3 pk.

3. 17 hr.      7. 3 pk. 2 qt.  
      9 hr. 50 min.      2 pk. 7 qt.

4. 1 yd. 1 ft. 1 in.      8. 11 wk. 1 da.  
      2 ft. 9 in.      9 wk. 5 da.

5. 25 gal. 1 qt.      9. 5 T. 896 lb.  
      6 gal. 3 qt.      1984 lb.

**211. Multiply :**

1. 12 lb. 7 oz.  $\times$  3

3 times 7 ounces are 21 ounces, or 1 pound 5 ounces. Write 5 ounces. 3 times 12 pounds are 36 pounds, and 1 pound to carry are 37 pounds. *Ans.* 37 lb. 5 oz.

2. 3 hr. 10 min.  $\times$  7

7. 7 min. 18 sec.  $\times$  10

3. 4 T. 985 lb.  $\times$  11

8. 9 gal. 3 qt.  $\times$  2

4. 7 bu. 3 pk.  $\times$  9

9. 2 ft. 9 in.  $\times$  8

5. 3 wk. 4 da.  $\times$  4

10. 1 yd. 1 ft. 6 in.  $\times$  6

6. 4 yd. 1 ft.  $\times$  5

11. 3 yr. 4 mo.  $\times$  7

**212. Divide:**

1. 9 lb. 2 oz.  $\div$  2

$\frac{1}{2}$  of 9 pounds is 4 pounds and 1 pound remainder, or 16 ounces. Add to this 2 ounces, giving 18 ounces for the dividend.  $\frac{1}{2}$  of 18 ounces is 9 ounces.  $\begin{array}{r} 2 \overline{) 9 \text{ lb. } 2 \text{ oz.}} \\ 4 \text{ lb. } 9 \text{ oz.} \end{array}$

*Ans.* 4 lb. 9 oz.

2. 31 gal. 2 qt.  $\div$  9

7. 19 ft. 2 in.  $\div$  10

3. 19 hr. 21 min.  $\div$  3

8. 34 T. 936 lb.  $\div$  4

4. 26 bu. 1 pk.  $\div$  5

9. 17 wk. 1 da.  $\div$  6

5. 41 min. 44 sec.  $\div$  8

10. 52 yd. 0 ft. 9 in.  $\div$  11

6. 18 yd. 2 ft.  $\div$  7

11. 23 yr. 4 mo.  $\div$  7

**213. Divide:**

1. 18 lb. 4 oz. by 4 lb. 9 oz.

$18 \text{ lb. } 4 \text{ oz.} = 292 \text{ oz.}$

$4 \text{ lb. } 9 \text{ oz.} = 73 \text{ oz.}$

$292 \text{ oz.} \div 73 \text{ oz.} = 4, \text{ } \textit{Ans.}$

**NOTE.**—Change the divisor and the dividend to the same denomination. The answer is an abstract number.

2. 16 yd. by 2 yd. 2 ft.
3. 51 hr. 36 min. by 6 hr. 27 min.
4. 47 min. 42 sec. by 5 min. 18 sec.
5. 84 yr. 7 mo. by 12 yr. 1 mo.
6. 19 da. 3 hr. by 2 da. 3 hr.
7. 3 mi. 40 rd. by 125 rd.
8. 103 T. 808 lb. by 8 T. 1234 lb.
9. 52 gal. 2 qt. by 3 gal. 2 qt.
10. 68 bu. 1 pk. by 5 bu. 1 pk.
11. 30 ft. 8 in. by 1 ft. 11 in.
12. 52 yd. 9 in. by 4 yd. 2 ft. 3 in.
13. 51 wk. 3 da. by 2 wk. 6 da.

## 214. Oral Problems.

1. What will be the weight of 16 hams that average 10 lb. 5 oz. each?
2. From a chest of tea containing 54 pounds there were sold 27 lb. 7 oz. How many pounds remain?
3. Seven bushels of potatoes are divided among 8 persons. How many pecks and quarts does each receive?
4. How many square inches in the surface of a sheet of paper measuring 11 inches by 13 inches?
5. How many feet and inches in  $\frac{4}{5}$  yard?
6. What decimal of a pound is 14 ounces?
7. A man buys a bushel of hickory nuts. After he sells 2 pk. 4 qt., what fraction of the bushel has he left?
8. A dealer puts 30 gallons of milk in cans holding 1 qt. 1 pt. each. How many cans does he fill?
9. At \$24 per month, how much rent will a man pay in 1 year and 5 months?

10. 75 hundredths of a pound is how many ounces?
11. How many feet in 5 rods?
12. 7 qt. 1 pt. of milk is divided among 5 people. How many quarts and pints does each receive?
13. What fraction of 2 lb. 3 oz. is 1 lb. 4 oz.?
14. Three-eighths of a ton is how many pounds?
15. Change 9 hr. 36 min. to the fraction of a day.

#### 215. Written Problems.

1. 32 hams weigh 464 pounds. What is the average weight?
2. 595 gallons of oil are put into 14 barrels. How many gallons and quarts does each contain?
3. If there are 42 gallons and 2 quarts in a barrel of oil, how much oil will there be in 15 barrels?
4. A piece of cloth containing 57 yards is divided equally among six persons. What is the length of each one's share?
5. How many minutes in a day?
6. July 1 is the last school day. How many days' vacation will there be, if school begins September 6?
7. How many hours and minutes are there from half-past 3 Saturday afternoon to a quarter before 9 Monday morning?
8. How many steps, 2 ft. 6 in. long, must a man take in walking 1200 feet?
9. A man owns a plot of ground 420 feet long, 240 feet wide. How many rods of fence will be required to enclose it?
10. A train goes from Jersey City to Washington, 228 miles, in 4 hr. 12 min. How many miles an hour does it travel? How long does it take the train to go one mile?

11. On Monday a boarding-house uses 3 gallons 2 quarts of milk; on Tuesday, 4 gallons; on Wednesday, 3 gallons 1 quart; on Thursday, 4 gallons 2 quarts; on Friday, 6 gallons; on Saturday, 5 gallons 2 quarts; on Sunday, 3 gallons. How much is used during the week, and what is the average per day?

12. June 21 the sun rises at New York at 4.23 A.M. and sets at 7.40 P.M. How long is the night?

13. From  $3\frac{7}{8}$  bushels take 3 pecks.

14. What is the number of rods in the perimeter of a field 206 ft. 3 in. wide and twice as long?

### MEASUREMENTS.

#### 216. Written Exercises.

How many *square inches* in each of the following rectangles? First change each dimension to inches.

- |                               |                          |
|-------------------------------|--------------------------|
| 1. 42 in. by 36 in.           | 6. 9 ft. by 11 ft.       |
| 2. 71 in. by 18 in.           | 7. 27 in. by 30 in.      |
| 3. 3 ft. 1 in. by 4 ft. 2 in. | 8. 65 in. by 92 in.      |
| NOTE. — 37 in. by 50 in.      | 9. 7 ft. 3 in. by 2 yd.  |
| 4. 5 ft. 3 in. by 6 ft. 4 in. | 10. 3 yd. by 6 ft. 6 in. |
| 5. 12 ft. by 18 ft.           | • (108 in. by 78 in.)    |

217. How many *square feet* in each of the following rectangles? First change each dimension to feet, or to feet and a fraction.

- |                                          |                                 |
|------------------------------------------|---------------------------------|
| 11. 18 ft. by 24 ft.                     | 15. $3\frac{1}{2}$ ft. by 4 ft. |
| 12. 36 in. by 4 ft.<br>(3 ft. by 4 ft.)  | 16. 3 ft. by $1\frac{1}{8}$ yd. |
| 13. 6 yd. by 8 yd.<br>(18 ft. by 24 ft.) | 17. 42 in. by 4 ft.             |
| 14. 1 yd. by 48 in.                      | 18. 25 ft. by 17 ft. 6 in.      |
|                                          | 19. 42 in. by 48 in.            |
|                                          | 20. 13 yd. by 15 yd.            |

218. How many *square yards* in each of the following rectangles? Change each dimension to yards, or to yards and a fraction.

21. 18 yd. by 25 yd.

26. 36 yd. by 24 in.

22. 15 yd. by 1 yd. 1 ft.

27. 17 ft. 6 in. by 32 in.

23. 27 ft. by 36 ft.

28. 22 ft. 9 in. by 18 in.

24. 54 ft. by 2 ft. 6 in.

29. 108 in. by 90 in.

25. 24 yd. by 27 in.

30. 180 ft. by 54 in.

219. Oral Exercises.

1. If a table is 3 yards long and 2 yards wide, how many square feet in it?

2. If it takes 24 yards of carpet, a yard wide, to cover a floor, how many yards  $\frac{3}{4}$  yard wide will be needed for the same floor?

3. How many square inches in  $\frac{1}{4}$  of a square foot?

4. A room is 21 feet long and 18 feet wide. What will it cost, at 5 cents per yard, for a strip of moulding around the walls?

5. How many square yards of carpet would be needed for the floor of the above room?

6. A field is 40 rods long and 26 rods wide. What is the distance around it?

7. What will it cost to carpet a room 18 feet long, 15 feet wide, at 75 cents per square yard?

8. What is the cost of fencing a lot 24 rods long by 20 rods wide, at \$1.12 $\frac{1}{2}$  per rod?

9. My field is 100 rods long and 75 rods wide. How much is it worth at \$2 a square rod? How much will it cost to fence it at \$1 a rod?

10. How many yards of fence will be required to enclose a rectangular field 98 yards long and 50 yards wide?

**220. Written Problems.**

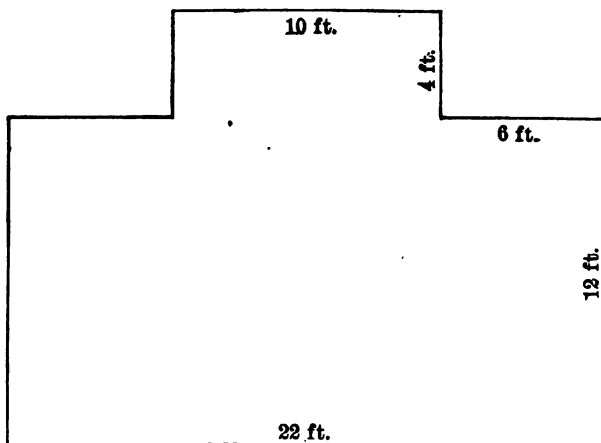
Make a diagram in each case:

1. A lot 25 feet by 100 feet has on it a house 25 feet by 55 feet. How many square feet are there left for a yard?
2. How many square feet are there in the floor of a room 24 feet long, 18 feet wide?
3. How many square yards are there in the ceiling of the same room?
4. Find the number of square yards of plastering needed for the end wall of a room 18 feet wide, 9 feet high, after deducting for two windows each 6 feet high,  $4\frac{1}{2}$  feet wide.
5. How many square yards of plastering will be needed for the opposite wall of the same room, 18 feet wide, 9 feet high, after deducting for a door  $7\frac{1}{2}$  feet high, 6 feet wide?
6. Calculate the number of square yards of plastering needed for two side walls of a room 24 feet long, 9 feet high, after deducting for a fireplace 6 feet square on one side.
7. A house 30 feet by 60 feet, with an addition 15 feet square, is built upon a lot 100 feet square. How many square feet of ground are covered by the building? How many square feet remain for a garden?
8. Measure the top of a brick and calculate the number of square inches in its surface. How many square inches in the surface of the bottom of the brick? Measure one side, and calculate its surface. How many square inches are there in the surface of the opposite side? How many square inches in each end?
9. Measure a crayon box, and calculate the number of square inches in each face.



10. Calculate the number of square feet in the floor of the classroom. In the ceiling. In each side wall. In each end wall.

11. What will it cost to put moulding around a room shaped like the drawing, allowing 3 inches on every corner for matching, the moulding being worth  $5\frac{3}{4}$ ¢ a foot?



12. The circumference of a circle is 3.1416 times the diameter. What is the diameter of a circular track 1760 yards in circumference? Find to two places of decimals.

13. Show the difference between 2 square inches and 2 inches square.

14. How many paving tiles 6 inches square are needed to cover a floor 18 feet long, 10 feet wide?

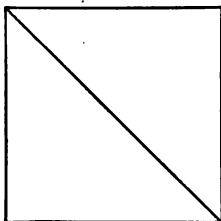
15. How many flagstones, each 4 feet long and 2 feet wide, will be needed to lay a crossing 32 feet long and 6 feet wide? What will be the cost of them at the rate of \$50 for 100 stones?

## AREAS OF RIGHT-ANGLED TRIANGLES.

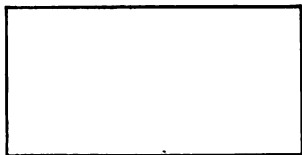
## 221. Preliminary Exercises.

The square shown in the diagram is divided into two parts by a diagonal. One side of the square measures 10 feet.

1. Mark in each triangle its area.



Square.

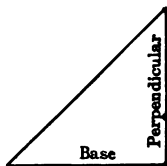


Rectangle.

2. Divide a rectangle 20 feet by 12 feet into two parts by a diagonal. Mark in each triangle its area.

3. Draw a right-angled triangle 3 inches by 4 inches. Calculate its area in square inches.

4. How many square yards in the surface of a right-angled triangle whose base measures 30 feet, and whose perpendicular measures  $22\frac{1}{2}$  feet?



## 222. Written Exercises.

Find the area in *square feet* of the following right-angled triangles. (Change each dimension to feet.)

1. Base 20 yards, perpendicular 30 feet.

Area = 1 square foot  $\times \frac{1}{4}$  ( $60 \times 30$ ) = 900 square feet, *Ans.*

*The number of square feet in the area of a right-angled triangle is equal to one-half the product of the number of feet in the base by the number of feet in the perpendicular.*

2. Base 16 inches, perpendicular 3 feet.
3. Base 30 inches, perpendicular 1 yard.
4. Base 3 feet 6 inches, perpendicular 5 feet.
5. Base 2 yards 1 foot, perpendicular 1 yard 9 inches.
6. Base 50 yards, perpendicular 36 yards.
7. Base  $112\frac{1}{2}$  feet, perpendicular 30 yards.
8. Base 90 inches, perpendicular 2 feet.
9. Base  $12\frac{1}{2}$  yards, perpendicular  $13\frac{1}{2}$  yards.
10. Base 1 rod, perpendicular  $7\frac{1}{2}$  feet.
11. Base  $33\frac{1}{2}$  feet, perpendicular 18 feet 6 inches.

## BILLS.

PHILADELPHIA, Sept. 24, 1905.

MR. WILLIAM J. HURLEY,

To JOHN J. PETIT &amp; SON, Dr.

*11. Complete bill  
has been put  
together for a  
month*

To 50 lb. Pipe	$5\frac{1}{2}\phi$			
To 3 Faucets	75¢			
To 1 Sink		4	75	
To $3\frac{1}{2}$ days' Labor	\$4.75			
				\$

1. Copy and complete the above bill.
2. Albert Janson has done  $3\frac{1}{2}$  days' work, @ \$3.50 per day, for Ephraim Whitlock. He charges for 850 feet lumber, at \$2 per hundred; 5 pounds of nails, at 9¢ per pound; 3 locks, @ 50¢; 2 bolts, at 10¢. Make out his bill.
3. A gardener furnishes 3 rose bushes, at 75¢; 4 grapevines, at 50¢; 11 fuchsias, at 30¢; 25 pansies, at 10¢. He charges \$3.25 per day for  $2\frac{1}{4}$  days' labor. Make out his bill.

4. An upholsterer charges \$ 3 per day for repairing some furniture. He supplies 6 pounds of hair, at 50¢ per pound; 17 yards of plush, at \$ 1.75 per yard; 3 papers of tacks, at 10¢; cord, gimp, etc., 47¢. He works 4 days. Make out his bill.

NOTE. — The foregoing bills are for work done and materials supplied. Notice how the heading differs from those in Arts. 103 and 173.

5. Make out and receipt a bill for four articles bought to-day by John Harrigan from Metz and Fagan, grocers (Art. 103).

6. Make out a bill containing ten items bought by Mrs. A. S. Jacobs, at different times during October, 1905, from Frederick Loeser & Co., dealers in dry goods (Art. 173).

7. Make out a bill for labor done and materials furnished by Joseph Minew, gardener.

# PERCENTAGE.

224. Per cent means hundredths.

Six per cent means six hundredths,  $\frac{6}{100}$ , or .06. It is written 6%.

225. Oral Exercises.

1. What is 6% of 200?

6% means  $\frac{6}{100}$ . To find 6% of 200, we multiply 200 by  $\frac{6}{100}$ , or  $200 \times .06$ . Ans. 12.

2. What is  $\frac{6}{100}$  of 300?

6. 6% of 150

3. Find .06 of 400

7. 6% of 250

4. 6 per cent of 500

8. 6% of 125

5. 6% of 50

9. 6% of 75

- |               |                             |
|---------------|-----------------------------|
| 10. 6% of 60  | 16. $\frac{1}{2}\%$ of 600  |
| 11. 6% of 160 | 17. $\frac{1}{2}\%$ of 600  |
| 12. 4% of 125 | 18. $2\frac{1}{2}\%$ of 600 |
| 13. 7% of 500 | 19. $3\frac{1}{2}\%$ of 400 |
| 14. 5% of 240 | 20. $\frac{1}{8}\%$ of 400  |
| 15. 1% of 600 | 21. 9% of 90                |

In solving examples in percentage, the work is frequently shortened by changing the per cent to a common fraction in its lowest terms.

$$75\% = \frac{75}{100} = \frac{3}{4}, \text{ Ans.}$$

226. What fraction equals :

- |                      |                     |                       |
|----------------------|---------------------|-----------------------|
| 1. 25%               | 5. 20%              | 9. $6\frac{2}{3}\%$   |
| 2. $12\frac{1}{2}\%$ | 6. 50%              | 10. $37\frac{1}{2}\%$ |
| 3. $33\frac{1}{3}\%$ | 7. $6\frac{1}{4}\%$ | 11. $62\frac{1}{2}\%$ |
| 4. $16\frac{2}{3}\%$ | 8. $3\frac{1}{8}\%$ | 12. $87\frac{1}{2}\%$ |

227. 1. Find 50% of 96.

$$50\% \text{ of } 96 = \frac{1}{2} \text{ of } 96 = 48, \text{ Ans.}$$

- |                             |                 |
|-----------------------------|-----------------|
| 2. 25% of 72                | 10. 150% of 140 |
| 3. $12\frac{1}{2}\%$ of 120 | 11. 250% of 140 |
| 4. $6\frac{1}{4}\%$ of 48   | 12. 125% of 140 |
| 5. $33\frac{1}{3}\%$ of 36  | 13. 1% of 140   |
| 6. $16\frac{2}{3}\%$ of 126 | 14. 1% of 350   |
| 7. $8\frac{1}{8}\%$ of 72   | 15. 2% of 350   |
| 8. 100% of 140              | 16. 3% of 350   |
| 9. 200% of 140              | 17. 4% of 350   |

## 228. Written Problems.

**NOTE.** — The pupils should find but little difficulty in solving these problems, which will serve to show a few applications of percentage. There is no need of preliminary explanation of terms the meaning of which can readily be determined from the context.

1. A merchant sells a lot of cotton for \$1872.50. He receives 2% of this amount for selling it. How much does he receive ?  
He receives  $\$1872.50 \times .02$ .

2. How much will it cost me to insure goods to the amount of \$18,760 at one per cent ?

3. A dealer imports books worth \$548.40, on which he pays duty to the government at the rate of 25%. What is the amount of the duty ?

4. Eighty per cent of a class of 55 pupils are promoted. How many are not promoted ?

5. A man buys a house for \$16,000 and sells it at an advance of 3 per cent over the cost. How much does he gain ?

6. A clerk spends for rent 18 per cent of his income of \$1850 per year. What rent does he pay ?

7. A girl spelled correctly 95 per cent of 60 words. How many did she miss ?

8. Tea costing 40 cents per pound is sold at a profit of 50 per cent. What is the selling price ?

9. I loan \$600 at 6% interest per year. How much interest should I receive from January 1, 1903, to January 1, 1905 ?

10. I loan a person \$600 on July 1, 1903. He agrees to pay me 5% of the amount loaned per year as interest. How much interest should I receive July 1, 1904 ?

11. A house is valued at \$6000. How much taxes must the owner pay at the rate of \$1.25 per \$100 valuation ?

## INTEREST.

## 229. Oral Exercises.

NOTE.—A preliminary talk with the class should develop the fact that a person hiring a horse is charged for its use, say so much an hour; that a person hiring a house is charged so much a month or a year for its use. A person borrowing money is also charged for the use of money. As the sum charged for the rent depends upon the size and value of the house, so the sum charged for the use of money depends upon the sum loaned.

A charge for use of money is called *interest*. The sum on which the interest is paid is called the *principal*. The price or *rate* is a certain per cent for a year.

1. What will be the interest on \$ 100 for 1 year at 4% ?

$$\text{\$ } 100 \times .04 = \text{\$ } 4, \text{ Ans.}$$

2. On \$ 200 for a year at 5% ?  
3. On \$ 300 for a year at 6% ?  
4. On \$ 400 for a year at 7% ?  
5. On \$ 250 for a year at 4% ?

At 4% per year, what will be the interest :

6. On \$ 200 for 1 year ?  
7. On \$ 300 for 2 years ?  
8. On \$ 100 for 3 years ?  
9. On \$ 200 for  $1\frac{1}{2}$  years ?  
10. On \$200 for 1 year 6 months ?  
11. What will be the interest on \$ 200 for 3 years at 5% ?

The interest for 1 year will be  $\text{\$ } 200 \times .05$ , or \$ 10 ; for three years it will be 3 times \$ 10, or \$ 30, *Ans.*

12. On \$ 300 for 2 years at 6% ?  
13. On \$ 400 for 6 years at 3% ?  
14. On \$ 100 for 5 years at 7% ?

15. On \$ 250 for 2 years at 4% ?
16. On \$ 100 for 1 year 6 months at 6% ?
17. On \$ 200 for 3 months at 4% ?

At 4% per year, what will be the interest:

18. On \$ 200 for 6 months ?

$$\$200 \times .04 \times \frac{1}{2}.$$

19. On \$ 300 for 4 months ?
20. On \$ 400 for 3 months ?
21. On \$ 300 for 2 months ?
22. On \$ 150 for 1 month ?
23. Find the interest on \$ 24 for 1 year at 5%.
24. On \$ 36 for 1 year at 4%.
25. On \$ 67 for 1 year at 3%.

### 230. Written Exercises.

Find the yearly interest on:

1. \$ 286.50 at 4% \$ 286.50

Multiply the principal by the rate, 4%, written as .04  
a decimal. \$ 11.4600

Ans. \$ 11.46.

- |                               |                                    |
|-------------------------------|------------------------------------|
| 2. \$ 485 at 6%               | 12. \$ 168 at $3\frac{1}{4}\%$     |
| 3. \$ 375.40 at 5%            | 13. \$ 244 at $5\frac{1}{2}\%$     |
| 4. \$ 379 at 3%               | 14. \$ 890 at $7\frac{2}{10}\%$    |
| 5. \$ 486 at $4\frac{1}{2}\%$ | 15. \$ 63.75 at 4%                 |
| 6. \$ 186.75 at 4%            | 16. \$ 937.50 at 6%                |
| 7. \$ 199.50 at 2%            | 17. \$ 980.40 at 5%                |
| 8. \$ 636 at $3\frac{1}{2}\%$ | 18. \$ 159.60 at $2\frac{1}{2}\%$  |
| 9. \$ 84.70 at 6%             | 19. \$ 1357.37 at 7%               |
| 10. \$ 93.25 at 8%            | 20. \$ 2146.18 at $4\frac{1}{2}\%$ |
| 11. \$ 1257 at 7%             | 21. \$ 369.40 at $3\frac{1}{4}\%$  |



Find the interest on :

\$ 290 for 2 years at 4%.

The interest for 1 year is \$ 290.

\$ 11.60. Multiplying by 2, we  $\frac{.04}{2}$

get the interest for 2 years, \$ 11.60 interest for 1 year

\$ 23.20.  $\frac{2}{2}$

Ans. \$ 23.20 interest for 2 years

*Multiply the principal by the rate expressed as hundredths, and this product by the time expressed in years and fraction of a year.*

22. \$ 1400 for 3 years at  $4\frac{1}{2}\%$ .

23. \$ 2840 for 4 years at 5%.

24. \$ 1250 at 6% for 3 years.

25. \$ 5360 at  $5\frac{1}{2}\%$  for 2 years.

26. \$ 380 at 3% for  $4\frac{1}{2}$  years.

27. \$ 780 for 1 year 4 months at 6%.

NOTE. — 1 year 4 months =  $1\frac{1}{3}$  year.

28. \$ 2560 for 2 years 6 months at 5%.

29. \$ 1025 for 3 years 3 months at 4%.

30. \$ 1296 for 7 months at 7%.

NOTE. — 7 months =  $\frac{7}{12}$  year.

31. \$ 648 for 5 months at 5%.

32. \$ 275 for 4 months at 3%.

33. \$ 1000 for 11 months at 6%.

### 231. Oral Problems.

1. I bought a house for \$ 4000, and sold it for 80% of the cost. For what did I sell it?

2. A merchant whose income is \$ 2000 a year spends 75% of it. How much does he save?

3. John has \$ 30 in the bank, Mary has  $16\frac{1}{2}\%$  as much. How much has Mary ?

4. If I buy goods for \$ 400 and sell them at a loss of 5%, how much do I lose ?

5. A farmer had 100 sheep and sold 20% of them. How many did he sell ?

6. Cloth shrinks 5% of its length in sponging. What is the shrinkage of a piece which contained 40 yards before sponging ?

7. In a school of 400, 60% are boys. How many girls in the school ?

8. What is the interest on \$ 100 for 2 years at 4% ?

9. What is the interest on \$ 50 for one year at 6% ?

10. What is the interest on \$ 200 for 2 years at  $3\frac{1}{2}\%$  ?

### 232. Written Problems.

1. A man receives a salary of \$ 1800 a year; he pays 15% of it for board,  $8\frac{1}{2}\%$  for clothing, and 16% for other expenses. What are his yearly expenses ?

2. My expenses during the month of April were \$ 185.68; my expenses in May were  $12\frac{1}{2}\%$  less than in April. What were my expenses in May ?

3. A lawyer collected 80% of a debt of \$ 2360 and charged 5% commission on the sum collected. How much did the creditor receive ?

4. A house was insured for \$ 3600 at  $1\frac{1}{2}\%$ . What was the cost of the insurance ?

5. What is the interest on \$ 550 for 2 years 6 months at 4% ?

6. What is the interest on \$ 1200 for 3 years at 5% ?

7. A merchant sold goods that cost \$ 2180 at a gain of  $33\frac{1}{3}\%$ . How much did he receive for them ?

8. What is the interest on \$720 for 1 year 6 months at 7%?

9. I bought 1260 pounds of sugar at  $4\frac{1}{2}$  cents a pound and sold it at a gain of 10%. How much did I sell it for?

10. What is the interest on \$350 for 2 years at  $3\frac{1}{2}$ %?

### APPROXIMATIONS.

These approximation examples should not be neglected. Pupils, besides finding them useful in preventing gross errors in their calculations, will be enabled later to obtain exact results to similar examples by an extension of the methods used in obtaining approximate results. In a following chapter will be found suggestions as to the product by 99, 24,  $99\frac{1}{2}$ , etc.

Some pupils can probably give the exact answer to No. 5—96 lb. at 25¢ would be \$24; at  $\frac{1}{2}$ ¢ less per lb., the cost would be 12¢ ( $\frac{1}{2}$ ¢  $\times$  96) less than \$24. The exact answers to Nos. 2, 3, 8, 9, and 10 can be obtained in a similar manner.

After the examples have been used for sight exercises in approximate answers, they should be solved for the exact answers.

SUGGESTIONS. — (1) 24 @  $\$ \frac{1}{2}$ . (2) 24 @ \$125. (3) 64 @  $\$ \frac{1}{2}$ .  
(4) 485 @ \$1. (11)  $\$27 + \$ \frac{1}{2}$ . (12)  $\$300 + \$1\frac{1}{2}$ . (13)  $\$24 + \$ \frac{1}{2}$ .

233. Give approximate answers, at sight:

1. 23 $\frac{1}{2}$  lb. of tea @ 50 $\frac{1}{2}$ ¢.
2. 24 horses @ \$124.95.
3. 64 yd. of carpet @ 87 $\frac{1}{8}$ ¢.
4. 485 bu. of wheat @ 99 $\frac{1}{2}$ ¢.
5. 96 lb. of coffee @ 24 $\frac{1}{2}$ ¢.
6. 840 yd. of dress goods @ 33 $\frac{5}{8}$ ¢.
7. 360 yd. of oil cloth @ 66 $\frac{1}{2}$ ¢.
8. 48 cwt. of straw @ 62 $\frac{1}{2}$ ¢.
9. 92 hats @ \$1.49 $\frac{1}{2}$ .
10. 128 lb. of lard @ 12 $\frac{1}{2}$ ¢.

*Where are such prices ever charged except in this arithmetic.*

**234.** Give approximate answers in whole numbers:

11.  $\$27 + 24\frac{1}{2}$

21.  $17.3 \times 3.98765$

12.  $\$299.96 + \$1.49\frac{1}{2}$

22.  $256.008 \times .249875$

13.  $\$24.05 + 37\frac{9}{16}$

23.  $25.1234 \times 15.93$

14.  $\$15.03 + 12\frac{5}{8}$

24.  $6.12 \times 6.12$

15.  $\$60 + \$2.49\frac{1}{2}$

25.  $86.4 \times .996$

16.  $\$32 + 33\frac{3}{8}$

26.  $33.333 \times 5.004$

17.  $\$69.95 + 87\frac{1}{2}$

27.  $799.387 \times .125$

18.  $\$60 + 62\frac{7}{16}$

28.  $7.999 \times 7.99$

19.  $\$64 + 66\frac{1}{8}$

29.  $7.33 \times 11.0083$

20.  $\$27.95 + \$1.75$

30.  $64.002 \times .3750$

### SPECIAL DRILLS.

**NOTE.**—It is important for pupils to keep up their previous practice in handling large numbers without a pencil, and to increase the size of the numbers from year to year.

To add 135 and 89, the pupil first adds 80, then 9.

$$135 + 80 (215) + 9 = 224$$

**235.** Give sums:

256 + 56

576 + 76

437 + 73

832 + 99

394 + 77

646 + 85

768 + 48

543 + 78

$$690 + 450 = 690 + 400 + 50$$

350 + 680

440 + 590

570 + 640

750 + 250

770 + 260

620 + 480

330 + 880

980 + 670

**236. Give differences:**

To subtract 56 from 312; first deduct 50, then 6.

$$312 - 56 = 312 - 50 (262) - 6 = 256$$

$$224 - 89 \qquad 652 - 76 \qquad 500 - 73 \qquad 931 - 99$$

$$471 - 77 \qquad 731 - 85 \qquad 816 - 48 \qquad 621 - 78$$

$$1200 - 610 = 1200 - 600 - 10$$

$$1140 - 690 \qquad 1130 - 870 \qquad 1210 - 570$$

$$1030 - 350 \qquad 1100 - 620 \qquad 1650 - 980$$

**237. Give products:**

$$98 \times 4 = 90 \times 4 (360) + 8 \times 4 (32) = 392$$

$$89 \times 5 \qquad 67 \times 7 \qquad 98 \times 4 \qquad 79 \times 3$$

$$78 \times 6 \qquad 75 \times 9 \qquad .66 \times 8 \qquad 89 \times 2$$

**238. Oral Problems.**

**NOTE.** — These problems should first be solved as sight exercises from the book. Afterward, one should be read by the teacher and the answer written by all the pupils at a given signal. These problems require no analysis. They contain numbers similar to those of the special drills on the previous page.

1. I sold 375 bushels of wheat to one miller and 87 to another. How many bushels did I sell?

2. Bought goods to the amount of \$4.29. How much change from a \$5 bill?

3. What will be the cost of 89 tons of coal at \$5 per ton?

4. If 49 hats cost \$147, what is the cost of one hat?

5. 567 marbles are divided among 9 boys. How many does each receive?

6. What will be the cost of a barrel of flour at \$5.25 and 8 pounds of sugar at 6¢?

7. How much must be paid for 55 pounds of raisins, at 8¢ per pound?

8. Find the cost of 320 pounds of hay at 60¢ per hundred pounds.

9. A father earned \$14.60, his son earned \$7.80. What were the earnings of both?

10. There are 36 inches in a yard. How many yards are there in 324 inches?

11. The product is 925, the multiplier is 25. What is the multiplicand?

12. What price was paid for 20 sheep, at \$8.75 per head?

13. A man saved \$320 per year for 5 years. How much more would he require to make \$2000?

14. Mr. Jones sold a lot for \$675, thereby losing \$85. What did he pay for it?

### RATIO.

#### 239. Written Problems.

NOTE. — Indicate operations, and cancel where possible.

1. If 56 men can pave a street in 24 days, how long will it take 32 men to pave it?

ANALYSIS. — One man will take 56 times as long as 56 men; and 32 men will do the work in  $\frac{1}{2}$  of the time required by 56 men.

Problems of this kind, involving only multiplication and division, are sometimes shortened by cancellation. Instead of multiplying 24 days by 56, and dividing the product by 32, the pupil should indicate these

operations, then cancel:  $\frac{24 \text{ days} \times 56}{32} = 42 \text{ days, Ans.}$

2. When a vessel sails 168 miles a day, she completes her voyage in 14 days. In what time would she complete it if she sailed 196 miles a day?

At 168 miles per day, the voyage requires 14 days.

At 196 miles per day, it would require 14 days  $\times \frac{144}{144}$ .

3. If a field would support 64 sheep for 21 days, how long would it support 48 sheep?

4. If 42 men could build a wall in 24 days, how many men could build it in 18 days?

The pupil must first determine what is asked. In this problem, it is the number of men. The given number of men, 42, must first be written in the multiplicand.

To build a wall in 24 days requires 42 men. To build it in a shorter time would require more men, hence the ratio is  $\frac{14}{14}$ .

5. If 21 horses are worth as much as 35 cows, how many horses are worth as much as 55 cows?

6. A girl that wrote 36 letters to a line, took 15 lines in writing a piece of dictation. How many lines would a girl that wrote 30 letters to a line require for the same dictation?

7. If a boy that steps 27 inches at a time takes 1000 steps in going home from school, how many steps will be taken by a boy that steps 30 inches?

8. If 1920 bricks will build a wall 15 yards long, how many bricks will be required for a similar wall 24 yards long?

9. A train going 44 miles an hour, went a certain distance in 9 hours. How long would it take a train going 36 miles an hour to make the same trip?

10. Find the cost of one-fourth of a barrel of flour at the rate of 22 cents for 7 pounds.

A barrel of flour weighs 196 pounds.

11. Six men can do a certain piece of work in eighteen days. How long would it take eighteen boys to do the same work, if one man can do as much work as two boys?

12. If a certain quantity of flour will last 48 persons 57 days, how long will it last 38 persons?

### SHORT METHODS.

#### 240. Sight Exercises.

- |                               |                                                                                                            |
|-------------------------------|------------------------------------------------------------------------------------------------------------|
| 1. $68 \times 25$             | $68 \times 25 = \frac{1}{4}$ of 6800                                                                       |
| 2. $25 \times 49$             | $25 \times 49 = 49 \times 25 = \frac{1}{4}$ of 49 hundred<br>$= 12\frac{1}{4}$ hundred = 1225, <i>Ans.</i> |
| 3. $88 \times 12\frac{1}{2}$  | $\frac{1}{4}$ of 88 hundred                                                                                |
| 4. $24 \times 75$             | 13. $48 \times 37\frac{1}{2}$                                                                              |
| 5. $82 \times 12\frac{1}{2}$  | 14. $92 \times 50$                                                                                         |
| 6. $72 \times 25$             | 15. $32 \times 33\frac{1}{2}$                                                                              |
| 7. $25 \times 51$             | 16. $88 \times 25$                                                                                         |
| 8. $66 \times 33\frac{1}{2}$  | 17. $25 \times 97$                                                                                         |
| 9. $48 \times 75$             | 18. $16 \times 87\frac{1}{2}$                                                                              |
| 10. $24 \times 62\frac{1}{2}$ | 19. $66 \times 66\frac{1}{2}$                                                                              |
| 11. $96 \times 25$            | 20. $16 \times 66\frac{1}{2}$                                                                              |
| 12. $25 \times 81$            | 21. $18 \times 16\frac{1}{2}$                                                                              |

#### 241. Written Exercises.

- |                                |                        |
|--------------------------------|------------------------|
| 1. $9347 \times 25$            | $934700 + 4$           |
| 2. $863 \times 75$             | $(86300 \times 3) + 4$ |
| 3. $8123 \times 12\frac{1}{2}$ | $812300 + 8$           |

Dividing 8123 hundred by 8 gives a quotient of  $1015\frac{1}{8}$  hundred, the fraction of which the pupil should write at once as  $37\frac{1}{2}$  units without dividing out 300 units by 8. While he sets down the work in this way,  $8 \overline{)812300}$ , he should be able to write the remainder of the answer when 1015

he reaches the annexed ciphers.



- |                                 |                                 |
|---------------------------------|---------------------------------|
| 4. $6483 \times 33\frac{1}{2}$  | $\frac{1}{2}$ of 6483 hundred   |
| 5. $8123 \times 125$            | $\frac{1}{4}$ of 8123000        |
| 6. $9347 \times 250$            | 14. $33\frac{1}{2} \times 3870$ |
| 7. $9347 \times 2\frac{1}{2}$   | 15. $66\frac{2}{3} \times 3456$ |
| 8. $9347 \times 75$             | 16. $16\frac{2}{3} \times 1266$ |
| 9. $6483 \times 66\frac{2}{3}$  | 17. $8408 \times 62\frac{1}{2}$ |
| 10. $6488 \times 37\frac{1}{2}$ | 18. $3875 \times 37\frac{1}{2}$ |
| 11. $4896 \times 87\frac{1}{2}$ | 19. $1925 \times 12\frac{1}{2}$ |
| 12. $1284 \times 62\frac{1}{2}$ | 20. $7314 \times 250$           |
| 13. $75 \times 2468$            | 21. $6480 \times 125$           |

**242. Oral Problems.**

- What will be the cost of 49 pounds of coffee at 25¢ per pound?
- I paid \$14.75 for eggs at 25¢ a dozen. How many dozen did I buy?
- What will be paid for 88 bushels of wheat at 87½¢ per bushel?
- How many bushels of corn at 62½¢ per bushel can be bought for \$150? ( $\$150 \div \$\frac{1}{2}$ )
- How much will be paid for 99 yards of dress goods at 33½¢ per yard?
- How many yards of carpet at 66⅔¢ per yard can be bought for \$84?
- Find the cost of 15 dozen collars at 12½¢ each.
- Paid \$24 for cuffs at 16⅔¢ per pair. How many dozen pairs were bought?
- What will be the cost of 128 pounds of tea at 75¢ per pound?

10. A bale of cotton at  $6\frac{1}{4}$ ¢ per pound cost \$25. What was the weight of the cotton?

11. A farmer sold hay at 75¢ per hundredweight, receiving for it \$39. How many hundredweights did he sell?

12. How many barrels of mess pork at \$12.50 per barrel can be bought for \$175?

13. What will be the cost of 84 yards of carpet at \$1.25 per yard?

14. When wheat sells at \$1.12½ per bushel, how many bushels can be bought for \$199?

15. At \$3.50 each, what will be paid for 42 coats?

16. Find the cost of 28 hats at \$2.75 each.

17. A real estate agent sold 97 lots at \$250 each. How much did he receive for them?

$$(\$250 = \frac{1}{4} \text{ of } \$1000)$$

18. What will be the cost of 248 horses at \$125 each?

19. At  $\frac{1}{2}$  cent each, how many penholders can I buy for \$4.32?

20. Paid \$3075 for cows at \$75 each. How many were bought?

### REVIEW OF FRACTIONS.

NOTE. — Practice in the sight work such as is given in the following examples will enable pupils to dispense with some of the aids they found necessary to employ during the earlier stages of work in fractions. These exercises should be answered one at a time from the book or the blackboard, preferably the latter. At a later lesson, the teacher should require the answers to five or ten examples selected promiscuously, to be written from the book or the blackboard, the examples to be announced by the teacher by number. At the same, or another lesson, the teacher should read a few, the answers to be written one at a time. In these examples pupils should not take pen or pencil until the signal is given to write the answer. No change should be made in an answer after it is written.

243. Write answers at sight:

1. Add  $32\frac{1}{2}$  and  $15\frac{3}{4}$ .

Mentally changing the fractions to twelfths, the pupil proceeds as follows:  $32\frac{1}{12} + 15(47\frac{1}{12}) + \frac{1}{12} = 47\frac{1}{12} = 48\frac{1}{12}$ , *Ans.*

2.  $24\frac{1}{2} + 15\frac{3}{4}$ .

4.  $62\frac{1}{2} + 23\frac{3}{4}$ .

3.  $50\frac{3}{4} + 20\frac{1}{2}$ .

5.  $40\frac{3}{4} + 33\frac{1}{2}$ .

6. From  $78\frac{1}{2}$  take  $20\frac{3}{4}$ .

SUGGESTION. —  $20\frac{3}{4}$  from 78 (and  $\frac{1}{2}$ ) leaves  $57\frac{1}{2}$  (and  $\frac{1}{4}$ ),  $57\frac{1}{2} + \frac{1}{4}$ . *Ans.  $57\frac{3}{4}$ .*

7.  $80\frac{1}{2} - 40\frac{1}{4}$ .

9.  $33\frac{1}{2} - 16\frac{3}{4}$ .

8.  $43\frac{1}{2} - 12\frac{3}{4}$ .

10.  $54\frac{1}{2} - 30\frac{3}{4}$ .

11. Multiply  $20\frac{3}{4}$  by 6.

Six times  $20(120) + 6$  times  $\frac{3}{4}(4) = 124$ , *Ans.*

12.  $12\frac{3}{4} \times 8$ .

14.  $12\frac{3}{4} \times 9$ .

13.  $30\frac{3}{4} \times 10$ .

15.  $11\frac{1}{2} \times 6$ .

16. Divide  $24\frac{3}{4}$  by 2.

$\frac{1}{2}$  of  $24(12) + \frac{1}{2}$  of  $\frac{3}{4}(\frac{1}{2}) = 12\frac{1}{4}$ , *Ans.*

17.  $48\frac{3}{4} \div 6$ .

19.  $80\frac{3}{4} \div 4$ .

18.  $23\frac{3}{10} \div 3$ .

20.  $55\frac{1}{10} \div 5$ .

21. Divide  $24\frac{3}{4}$  by 4.

$\frac{1}{4}$  of  $24(6) + \frac{1}{4}$  of  $\frac{3}{4}(\frac{1}{4}) = 6\frac{3}{16}$ , *Ans.*

22.  $60\frac{1}{2} \div 3$ .

24.  $28\frac{3}{4} \div 7$ .

23.  $40\frac{1}{2} \div 4$ .

25.  $36\frac{3}{4} \div 9$ .

26. Divide  $21\frac{1}{4}$  by 5.

$21\frac{1}{4}$  contains 5, 4 times, with a remainder of  $1\frac{1}{4}$ , or 5 fourths. *Ans.  $4\frac{1}{5}$ .*

27.  $17\frac{1}{2} \div 4$ .

29.  $26\frac{3}{4} \div 8$ .

28.  $19\frac{1}{2} \div 6$ .

30.  $19\frac{1}{2} \div 3$ .

31. Divide  $18\frac{3}{4}$  by 7.

$18\frac{3}{4} \div 7 = 2$ , with  $4\frac{3}{4}$  remainder.  $\frac{1}{7}$  of  $4\frac{3}{4} = \frac{1}{7}$  of  $4\frac{7}{8} = \frac{4}{8} = \frac{1}{2}$ . Ans.  $2\frac{1}{2}$ .

32.  $25\frac{1}{2} + 2$ .

34.  $19\frac{1}{2} \div 4$ .

33.  $31\frac{1}{2} \div 3$ .

35.  $22\frac{1}{2} \div 5$ .

#### 244. Written Exercises.

Perform indicated operations:

1.  $(1\frac{1}{2} \div \frac{2}{3}) + (6\frac{2}{3} \div \frac{1}{4})$

5.  $52\frac{1}{2} \times (1\frac{7}{8} - 1\frac{5}{8})$

2.  $\frac{(\frac{3}{4} \times 20) - (4\frac{1}{4} \times 2\frac{3}{4})}{\frac{1}{3} + \frac{2}{5}}$

6.  $\frac{4\frac{1}{2} + 3\frac{1}{2} - 6\frac{7}{8}}{5}$

3.  $\frac{16}{\frac{2}{3} \text{ of } 4\frac{1}{2}} + \frac{5\frac{1}{2}}{\frac{1}{3} \text{ of } 1\frac{1}{2}}$

7.  $\frac{\frac{2}{3} \text{ of } \frac{3}{4}}{15} \div \frac{\frac{5}{8} \text{ of } 2\frac{3}{4}}{8}$

4.  $23\frac{3}{4} \div (3\frac{1}{2} + 1\frac{2}{5})$

8.  $\frac{2}{7} \text{ of } (3\frac{1}{2} - 2\frac{1}{2} + 9\frac{1}{2})$

#### 245. Find answers:

9. Simplify  $\frac{2 + 5\frac{1}{2} - 3\frac{3}{4}}{3 + 1\frac{1}{2} - 2\frac{2}{3}}$ .

10. Find the sum of  $\frac{4}{5}, \frac{5}{16}, \frac{7}{20}, \frac{2}{25}, \frac{12}{100}$ .

11. Reduce  $\frac{1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4}}{1 + \frac{1}{2} - \frac{1}{3} - \frac{1}{4}}$  to a simple fraction.

12. Divide  $(\frac{1}{2} + \frac{1}{3} + \frac{2}{5})$  by  $(\frac{2}{3} \times \frac{1}{2} \times \frac{1}{3})$ .

13. Simplify  $\frac{1 + \frac{1}{2}}{1 - \frac{1}{2}}$  of  $\frac{2}{3}$  of  $\frac{1}{1\frac{1}{2}}$ .

14.  $\frac{7\frac{1}{2} - 3\frac{1}{4}}{7\frac{1}{2}} = ?$

15. Find the value of  $\frac{4\frac{1}{2} + (\frac{2}{3} \text{ of } \frac{7}{16})}{(\frac{5}{8} \text{ of } 1\frac{1}{2}) - \frac{2}{3}}$ .

16.  $(2\frac{1}{2} + 1\frac{1}{3}) \div (2\frac{1}{2} + 3\frac{1}{3}) = ?$

17. Find the value of  $2\frac{1}{2}$  times the quotient of  $(3 - 2\frac{1}{2}) \div (2\frac{1}{2} - \frac{5}{8})$ .

18.  $3\frac{1}{2} + 14 - 7\frac{3}{4} + 5 - \frac{2}{15} = ?$

**246.** Multiply. Do not reduce to improper fractions.

$$\begin{array}{r} 12\frac{3}{4} \\ \times 4\frac{1}{8} \\ \hline 51 \\ 4\frac{1}{4} \\ \hline 55\frac{1}{2} \end{array}$$

4 times  $12\frac{3}{4} = 51$ ;  $\frac{1}{8}$  of  $12\frac{3}{4} = 4\frac{1}{4}$ .

1.  $18\frac{3}{8} \times 6\frac{1}{2}$

6.  $16\frac{3}{4} \times 7\frac{1}{2}$

2.  $25\frac{5}{8} \times 8\frac{1}{2}$

7.  $48\frac{3}{4} \times 12\frac{1}{2}$

3.  $16\frac{4}{5} \times 5\frac{1}{2}$

8.  $37\frac{3}{5} \times 10\frac{1}{2}$

4.  $36\frac{1}{2} \times 9\frac{1}{2}$

9.  $36\frac{2}{3} \times 9\frac{1}{3}$

5.  $22\frac{5}{8} \times 6\frac{1}{11}$

10.  $32\frac{3}{4} \times 8\frac{1}{2}$

**247.** Oral Review Problems.

1. What per cent does a boy receive if he solves 16 examples of the 20 given out?

2. What is the interest on \$200 at 4% for 2 years?

3. If  $2\frac{3}{4}$  yards of calico cost 22 cents, how many yards can be bought for 60¢?

4. How old, Dec. 1, 1904, was a boy born Sept. 1, 1891?

5. What is the cost of 3500 bricks at \$6 per M?

6. How many sheep, at \$5 each, should be given in exchange for 12 horses, worth \$200 each?

7. 75 men can do a certain piece of work in 9 days. How long will it take 45 men to do the same work?

8. If 4 barrels of oil each containing 42 gallons are emptied into a tank of 200 gallons' capacity, how many more gallons will the tank hold?

9. Change .375 yard to feet and inches.

10. How many half-pints in 2 gal. 1 qt.?

11. How many eggs in 15 dozen and 6 eggs?

12.  $\frac{4}{9}$  = how many 98ths?
13. Find the greatest common divisor of 12, 18, 27.
14. Find the least common multiple of 8, 9, 12.
15. How many yards in 5 pieces of cloth, each containing  $12\frac{3}{4}$  yards?
16. Divide  $29\frac{3}{8}$  by 7.
17. When silk is 75¢ per yard, how many yards can be bought for \$9.75?
18. If  $2\frac{1}{2}$  yards ribbon cost 42 cents, what will  $3\frac{1}{2}$  yards cost?
19. If eggs are sold at the rate of 18 for 25 cents, what will be the cost of 6 dozen eggs?
20. Three men require 22 days to do a certain piece of work. How long would it take 11 men to do the same work?
21. A farmer divides his farm of 425 acres into fields of  $12\frac{1}{2}$  acres each. How many fields has he?
22. What will be the cost of 46 tons of hay, at \$ $12\frac{1}{2}$  per ton?
23. What is the weight of 25 firkins of butter, each containing 56 pounds?
24. At \$1.75 per yard, how many yards of cloth can be bought for \$49?
25. If the interest of \$1 is 6¢ a year, what is the interest of three dollars for two years?
26. If 4 boxes of raisins cost \$7, what will 12 boxes cost?
27. A man having 75 dollars bought 7 sheep, and had \$5 left. What did he pay for each sheep?
28. A boy had 59 peaches and found 22 more; he then divided all of them equally among 9 boys. How many did he give to each?

29. I bought  $2\frac{1}{2}$  pounds of sugar at one store and  $3\frac{1}{2}$  pounds at another. How many pounds did I buy in all?

30. If  $\frac{7}{8}$  of a load of hay is worth \$14, what will two loads be worth?

31.  $2\frac{3}{4} + 1\frac{1}{2} = ?$

32.  $2\frac{3}{4} \times 1\frac{1}{2} = ?$

33.  $\frac{3}{4}$  of my money equals 63¢. What is  $\frac{1}{2}$  of it?

34. Least common multiple of 8, 12, 15, 24?

35. If 5 men can do a piece of work in 12 days, in how many days can 3 men do twice as much work?

36. John lost  $\frac{1}{4}$  of his money and has 96¢ left. How much had he at first?

37. At 6¢ a quart, what will 10 quarts 1 pint of milk cost?

38. I bought a dozen oranges at the rate of 4 oranges for 3¢, and sold them at the rate of 3 oranges for 4¢. How much did I make?

39. How long would it take 3 men to cut 12 cords of wood, if 4 men can cut 8 cords in 2 days?

40. John sold 24 tops at the rate of 3 tops for ten cents, and with the money bought pictures at 8¢ each. How many pictures did he buy?

41. How many pounds of cheese at  $\frac{1}{12}$  of a dollar per pound can be bought for  $\frac{3}{4}$  of a dollar?

42. 18 is  $\frac{3}{7}$  of  $\frac{7}{8}$  of what number?

43. If one man can do a piece of work in  $11\frac{1}{2}$  days, in what time can 12 men do it?

44. How many times is  $\frac{1}{3}$  contained in  $2\frac{1}{3}$ ?

45. If oranges are  $37\frac{1}{2}$  cents per dozen, what will be the cost of a box containing 480 oranges?

*Oranges are sold at 3¢ each. Such quantities as 480 oranges are contained from 96 to 304*

**248. Written Review Problems.**

1. At 70 cents per 100 pounds, what will be the amount of duty on an invoice of 3622 steel rails, each rail being 27 feet long and weighing 60 pounds to the yard?

2. A man had property valued at \$6500. What will be his taxes at the rate of \$10.80 per \$1000?

3. Multiply seventy thousand fourteen hundred-thousandths by one hundred nine millionths, and divide the product by five hundred forty-five.

4. What number multiplied by  $43\frac{1}{2}$  will produce  $265\frac{1}{2}$ ?

5. What decimal of a bushel is 3 quarts?

6. A man sells  $\frac{5}{8}$  of an acre of land for \$93.75. What would be the value of his farm of  $150\frac{1}{4}$  acres at the same rate?

7. A coal dealer buys 375 tons coal at \$4.25 per ton of 2240 pounds. He sells it at \$4.50 per ton of 2000 pounds. What is his profit?

8. Bought 60 yards of cloth at the rate of 2 yards for \$5, and 80 yards more at the rate of 4 yards for \$9. I immediately sold the whole of it at the rate of 5 yards for \$12. How much did I gain?

9. A man purchased 40 bushels of apples at \$1.50 per bushel. Twenty-five hundredths of them were damaged, and he sold them at 20 cents per peck. He sold the remainder at 50 cents per peck. How much did he gain or lose?

10. If oranges are  $37\frac{1}{2}$  cents per dozen, how many boxes, each containing 480, can be bought for \$60?

11. A man can do a piece of work in  $18\frac{1}{2}$  days. What part of it can he do in  $6\frac{3}{4}$  days?

12. How old to-day is a boy that was born Oct. 29, 1896?



13. At the rate of \$5 per ton, what should be paid for 125 pounds of coal?

14. From ten and five hundredths take the sum of six ten-thousandths and 15 millionths, multiply the remainder by one-tenth, and divide the product by 5000.

15. Reduce the following common fractions to decimals, and perform the operations indicated:

$$\left(\frac{41}{5000} \times 7\frac{1}{10}\right) + \frac{141}{200000}$$

16. A man died in 1903, aged 94; his son died in 1887, aged 47. How old was the man at the birth of his son?

17. Multiply the sum of  $6\frac{3}{4}$  and  $4\frac{1}{2}$  by their difference.

18. What will be the cost of 86,400 feet of gas at \$1.25 per thousand feet?

19. What time elapsed between the discovery of America, Oct. 14, 1492, and Jan. 1, 1904?

20. How many hats can be bought for \$237.25, at the rate of \$13 per dozen?

21. A clerk receives a salary of \$1500 per year, and his expenses are \$968. In what time can he save enough to buy 133 acres of land at \$28 per acre?

22. What will be the rent of a house for 1 yr. 10 mo. at \$45 per month?

23. The product is .00087, the multiplicand is 7.25. What is the multiplier?

24. A man sells cloth at \$2.88 per yard, losing .04 of the cost. How much did he pay per yard?

25. A farm hand agreed to work for \$300 per year and a horse worth \$60. If he leaves at the end of 9 months, how much is due him if he has already received \$100 and the horse?

26. A train running 36 miles per hour leaves a station at 9 A.M. At 10.30 A.M. a second train leaves and runs at the rate of 30 miles per hour. How many miles apart are the trains at noon, if they run in the same direction?

27. Multiply twenty thousand nine hundred eight by sixteen. Divide the result by seven.

28. Divide two hundred sixteen by thirty-six thousandths. Take seventy-five hundredths from the quotient.

29. If one acre yields 14 bu. 3 pk. cranberries, how much will 40 acres yield?

30. Find the difference between  $3\frac{1}{8} \times 6\frac{2}{3}$  and  $7\frac{1}{9} \div 1\frac{2}{3}$ .

31. An errand boy receives \$2.75 per week. In how many weeks will he earn enough to buy a pair of boots worth \$3.25, a coat worth \$4.75, a hat worth \$1.50, and 6 handkerchiefs worth 25 cents each?

32. How many cords of wood at \$5 $\frac{1}{4}$  a cord must I give for 78 $\frac{3}{4}$  bushels of wheat at \$1.20 a bushel, and 84 bushels of rye at \$1 a bushel?

33. Mr. Louis Scott bought from Thomas Green, at Philadelphia, Jan. 10, 1904, the following: 67 pairs of boots at \$3.25 per pair; 75 pairs of gaiters at \$1.12 per pair; 35 pairs of slippers at 70 cents per pair; 50 pairs of rubbers at 62 $\frac{1}{2}$  cents per pair. Make out and receipt the bill.

34. What will  $\frac{3}{4}$  of a yard of cloth cost, if  $\frac{1}{4}$  of a yard costs \$1.60?

35. Divisor  $3\frac{1}{8}$ ; quotient 400. Find dividend.

36. Dividend .014; quotient 2000. Find divisor.

37. Divide 118.35 by  $.04\frac{1}{2}$ , and add 3.0045 to the quotient.

38. If  $1\frac{1}{8}$  yards of cloth are worth 11 $\frac{1}{4}$  dollars, what is a yard worth?

39. If a roll of carpet, containing 75 yards, is worth \$132, what is  $\frac{2}{3}$  of a yard worth?

40. How many quarts of berries at 11 cents a quart will it take to buy  $2\frac{3}{4}$  yards of cloth at  $16\frac{1}{2}$  cents a yard?

41. A man sold  $\frac{1}{2}$  and  $\frac{1}{3}$  of his farm and had  $26\frac{1}{3}$  acres left. How many acres had he at first?

42. A boy sleeps  $\frac{3}{8}$  of his time, plays  $\frac{1}{4}$  of it, and goes to school one-half the remainder. How many hours is he in school each school day?

43. Write in four other ways the quantity or value expressed by .16.

44. Bought 3 bu. 2 pk. of oats for \$1.38 and retailed them at \$.12 $\frac{1}{2}$  a peck. What was the gain?

45. From a hogshead of molasses containing 54 gal. 2 qt. there was sold 23 gal. 1 pt. What was the value of the remainder at 8 cents a quart?

46. What is the result, if the sum of 5 yd. 2 ft., 3 yd. 1 ft., and 14 yd. 1 ft. be taken from 42 yards?

47. Reduce  $\frac{1}{2}$  of a day,  $\frac{2}{10}$  of an hour, and  $\frac{4}{15}$  of a minute to common denominator, and add.

48. Bought a carriage for \$180, and after paying 10% for repairs, sold it at a profit of 25% of the total cost. Find gain and selling price.

49. A man sold a horse for \$125, and received in payment  $12\frac{1}{2}$  yards of cloth at \$3.25 a yard, and the balance in tea at \$.62 $\frac{1}{2}$ . How many pounds of tea did he receive?

50. Find equivalent per cents for the following:  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{7}{8}$ ,  $\frac{3}{4}$ ,  $\frac{1}{12}$ ,  $\frac{1}{4}$ .

51. If 64 tons of iron cost \$4816, how many tons can be bought for \$1730.75?

52. Change 28 gal. 3 qt. to quarts.

53. A man carried to a store  $75\frac{1}{4}$  bushels of potatoes, and received for them  $27\frac{1}{8}$ ¢ a bushel. How many yards of cloth, at  $17\frac{3}{8}$ ¢ a yard, would have paid for them?

54. What will 75 men earn in  $18\frac{3}{4}$  days, if each earns  $2\frac{1}{2}$  dollars each day?

55. What will 8 yd. 2 ft. 6 in. of silver wire cost at  $8\frac{3}{8}$ ¢ an inch?

56. A young man spent \$195 $\frac{1}{2}$  during his first term at college, which was  $\frac{4}{5}$  of his year's allowance. What was his year's allowance, and what had he left for the remainder of the year?

57. A man paid \$18.60 for a load of hay weighing  $2\frac{3}{4}$  tons. At the same rate, what should he pay for  $\frac{3}{4}$  of a ton?

58. Divide 4.5006 by .015. *2*

59. One man owns  $\frac{75}{800}$  of an estate; another owns  $\frac{225}{800}$  of it; and a third man owns  $\frac{25}{800}$  of it. What part of the whole do they own together? *✓*

NOTE. — Reduce the fractions to lowest terms, by inspection.

60. If it takes 11 men  $45\frac{3}{8}$  days to do a piece of work, how many days will it take one man to do the same work?

61. I owned  $\frac{2}{3}$  of a house, and sold  $\frac{3}{4}$  of my share for \$1750. What was the value of the whole house at that rate?

62. A grocer, after selling  $\frac{1}{8}$ ,  $\frac{2}{5}$ ,  $\frac{3}{8}$ , and  $\frac{1}{4}$  of a quantity of sugar, had 102 pounds left. How many pounds did he have at first?

63. A dealer in grain bought wheat at 94¢ a bushel to the amount of \$59.22, and sold it for \$70.56. What was the selling price per bushel?

64. If  $\frac{5}{8}$  of a cord of wood is worth \$3.75, what will  $\frac{3}{4}$  of a cord cost?

65. A man who had \$50 $\frac{1}{2}$  received \$8 $\frac{1}{2}$  more, spent \$17 $\frac{3}{4}$ , lost \$4 $\frac{3}{4}$ , and collected \$15 $\frac{1}{4}$  of a debt. How much money had he then?

66. 12 $\frac{3}{4}$  is what part of 29?

67. What must a carpenter pay for the following: 6500 shingles, at \$4.75 per thousand; 15,964 feet of boards, at \$39.25 per thousand; 4849 feet of planks, at \$45.32 per thousand?

68. A farmer sold  $\frac{5}{8}$  of his wheat for \$796 $\frac{3}{4}$  and received for it \$1 $\frac{1}{10}$  per bushel. How many bushels did he have at first, and how many did he sell?

69. If 123 tons of coal cost \$848.70, what will be the cost of 265 tons?

70. A dealer sold  $\frac{5}{12}$  of his wheat to Mr. Adams,  $\frac{1}{3}$  of it to Mr. Baker, and  $\frac{5}{8}$  of it to Mr. Charles; then he had 630 bushels left. How much had he at first?

71. Mr. Blank bottled 135 gallons of ink in bottles that held  $\frac{3}{8}$  of a pint; he sold it for 12 $\frac{1}{2}$ ¢ a bottle. How much did he receive?

72. Three times a number, increased by  $\frac{6}{10}$  of the number, equals 22. What is the number?

73. A grocer having a capital of \$10,000, invested  $\frac{1}{3}$  of it in tea at  $\frac{7}{10}$  of a dollar per pound,  $\frac{5}{10}$  of the remainder in coffee at  $\frac{1}{4}$  of a dollar a pound, and  $\frac{2}{5}$  of the rest in sugar at 5 cents per pound. What quantity of each did he buy, and what money had he left?

74. What will be the cost of 53,715 pounds of wheat at 90 cents per bushel of 60 pounds?

75. A drover sold 15 cattle, weighing 1468 pounds each, at \$4.40 per hundred pounds. How much did he receive?

76. After losing  $\frac{3}{8}$  of his money, a man had \$75 left. How much had he at first?

*Prove that a grocer could invest \$5920 out a capital of \$10,000, in tea, coffee, and sugar.*

77. What will be the cost of 24 gallons 3 quarts of milk at 4 cents per pint?

78. A man bought a house for \$6250 and sold it for \$6500. What fraction of the cost is the profit? What decimal?

79. At \$30 per month, how much rent would a man pay from July 1, 1904, to May 1, 1906?

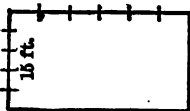
80. How many sheep at \$6.75 each should be given in exchange for 54 horses worth \$160 each?

81. A man spent three-tenths of his money for clothes, and one-fifth of it for rent, and had \$75 left. How much did his clothes cost?

82. What would be the cost of 48,500 stamped envelopes at \$21.30 per thousand?

83. The width of a room is  $\frac{5}{8}$  of its length. How many square feet in the floor, if the width is 15 feet?

84. If 2 lb. 6 oz. of tea cost 95 cents, how many pounds and ounces can be bought for \$2.35?



85. John and James went out together. John had 38 cents. When one of the boys had spent 18 cents and the other had spent 16 cents, they had 24 cents left between them. Find the amount of money James had.

86. Find  $\frac{1}{2}$  of the sum of  $\frac{2}{3}$  and  $\frac{3}{4}$ .

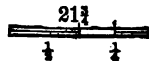
87. What is  $\frac{2}{3}$  of the difference between  $\frac{4}{5}$  and  $\frac{5}{6}$ ?

88. What fraction added to  $\frac{2}{3}$  gives  $\frac{3}{4}$ ?

89. Change  $1\frac{3}{11}$  hour to seconds.

90.  $\frac{5}{8}$  of what number equals 180?

91. The half of a number added to its fourth part equals  $21\frac{3}{4}$ . What is the number?



92. A farm is sold for \$5700, at a loss of  $\frac{1}{10}$  of the cost. What was the cost?

93. When it is noon at Philadelphia, it is 15 seconds and 10 minutes past 5 P.M. at Paris. What time is it at Philadelphia when it is noon at Paris?

94. A, B, and C buy a house.

A furnished  $\frac{1}{2}$  of the cost, B  $\frac{1}{3}$ , and C \$1200. What did A and B pay, respectively?

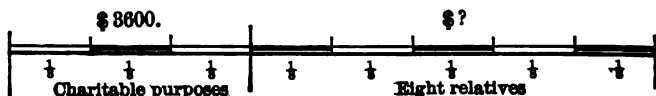


95. After James has spent  $\frac{3}{4}$  of his money and  $\frac{1}{2}$  of the remainder, he has but \$1.50 left. How much had he at first?

96. A man buys oranges at \$1.20 per 100. How many would he have to sell, at 25¢ per dozen, to gain \$3.18?

97. From a piece of cloth measuring  $28\frac{1}{2}$  yards, there have been sold  $2\frac{3}{4}$  yards,  $6\frac{5}{8}$  yards,  $13\frac{1}{4}$  yards. If the remainder is worth \$13.10, what was the value of the whole piece?

98. A man left for charitable purposes \$3600, which was  $\frac{3}{8}$  of his money. The remainder was divided equally among 8 relatives. How much did each relative receive?



## CHAPTER IV.

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### DENOMINATE NUMBERS.

#### 249. Preliminary Exercises.

- How many quarts in 5 gal. ?
- How many quarts in 5 gal. 3 qt. ?
- How many pints in 23 qt. ?
- How many pints in 23 qt. 1 pt. ?
- How many pints in 5 gal. 3 qt. 1 pt. ?

### REDUCTION DESCENDING.

#### 250. Reduce 5 gal. 3 qt. 1 pt. to pints.

In the first few examples, write 4 (the number of quarts in a gallon) above the quarts, and 2 (the number of pints in a quart) above the



pints. In 5 gallons there are 5 times 4 quarts, or 20 quarts; adding the 3 quarts, we have 23 quarts, as the equivalent of 5 gallons 3 quarts, which is written in the column of quarts. In 23 quarts there are 23 times 2 pints; adding 1 pint, we have 47 pints as the equivalent of 5 gallons 3 quarts 1 pint. This is written in the column of pints, the 23 quarts being cancelled.

$$\begin{array}{r}
 4 \text{ qt. } 2 \text{ pt.} \\
 5 \text{ gal. } 3 \text{ qt. } 1 \text{ pt.} \\
 \hline
 23 \text{ qt. } 47 \text{ pt.} \\
 \text{Ans. } 47 \text{ pt.}
 \end{array}$$

Changing a denominate number to an equivalent denominate number of a lower denomination is called *reduction descending*.

### 251. Written Exercises.

Reduce to pints:

- |                        |                                     |
|------------------------|-------------------------------------|
| 1. 16 gal. 1 qt. 1 pt. | 6. $31\frac{1}{2}$ gal.             |
| 2. 27 gal. 2 qt.       | 7. 9 gal. $2\frac{1}{2}$ qt.        |
| 3. 16 gal. ' .         | 8. 10 gal. 2 qt. 1 pt.              |
| 4. 16 gal. 1 pt.       | 9. 27 gal. 1 pt.                    |
| 5. 34 gal. 3 qt. 1 pt. | 10. 4 gal. 3 qt. $1\frac{1}{2}$ pt. |

### REDUCTION ASCENDING.

#### 252. Change 67 pt. to gallons, quarts, and pints.

Place 2 (the number of pints in a quart) above 67 pints. In 67 pints there are 33 quarts and 1 pint. Write 33 quarts to the left of 67 pints, and the 1 pint remainder in the column of pints. Change the 33 quarts to 8 gallons 1 quart, and cancel 33 quarts.

$$\begin{array}{r}
 4 \text{ qt. } 2 \text{ pt.} \\
 33 \text{ qt. } 67 \text{ pt.} \\
 \hline
 8 \text{ gal. } 1 \text{ qt. } 1 \text{ pt.} \quad \text{Ans.}
 \end{array}$$

Changing a denominate number to an equivalent denominate number of a higher denomination is called *reduction ascending*.

**253. Written Exercises.**

Change to gallons, etc.

- |             |             |
|-------------|-------------|
| 1. 156 qt.  | 6. 177 pt.  |
| 2. 79 qt.   | 7. 139 pt.  |
| 3. 408 pt.  | 8. 171 qt.  |
| 4. 1302 pt. | 9. 63 qt.   |
| 5. 63 pt.   | 10. 711 pt. |

**254.** Review the tables of Long Measure, Dry Measure, Liquid Measure, Avoirdupois Weight, and Time, Art. 93, pages 43-44.

Change:

1. 17 yd. 1 ft. 9 in. to inches.
2. 4 mi. 100 rd. 4 yd. to yards.
3. 74 bu. 2 pk. 7 qt. to quarts.
4. 156 lb. 11 oz. to ounces.
5. 63 yd. 0 ft. 3 in. to inches.
6. 19 bu. 0 pk. 3 qt. to quarts.
7. 11 rd.  $3\frac{1}{2}$  yd. to feet.
8. 63 gal. 3 qt. to pints.
9. 3 bu. 6 qt. to quarts.
10. 17 T. 369 lb. to pounds.
11. 15 hr. 16 min. to seconds.
12. 4 wk. 6 da. 11 hr. to hours.

**NOTE.**— Reduce a denominate fraction or a denominate decimal to lower denominations by multiplying.

13.  $\frac{5}{7}$  of a week to hours.
14.  $\frac{8}{8\frac{1}{2}}$  of a mile to yards.
15. .00125 ton to ounces.
16. 1876 inches to yards, etc.
17. 475 ounces to pounds, etc.

18. 729 quarts to bushels, etc.
19. 8675 minutes to days, etc.
20. 4972 pounds to tons, etc.
21. 972 rods to miles, etc.
22. 117 pints to gallons, etc.
23. 9483 seconds to hours, etc.
24. 877 quarts to bushels, etc.
25. 1495 ounces to pounds, etc.
26. 373 inches to yards, etc.
27. 216 quarts to gallons, etc.
28. 876 rods to miles, etc.
29. 319 pints to gallons, etc.
30. 3520 yards to miles.

### 255. Oral Exercises.

1. How many hours in  $\frac{3}{4}$  of a day?
2. How many hours in  $\frac{1}{2}$  of a day?
3. How many minutes in  $\frac{1}{3}$  of an hour?
4. How many hours and minutes in  $\frac{1}{4}$  of a day?

$\frac{1}{4}$  day =  $4\frac{1}{2}$  hours;  $\frac{1}{2}$  hour = 48 minutes.  $\frac{1}{2}$  day = 4 hours 48 minutes.

5. How many quarts and pints in  $\frac{3}{4}$  of a gallon?
6. How many hours and minutes in .2 day?

.2 day = 4.8 hours; .8 hour = 48 minutes. .2 day = 4 hours 48 minutes.

7. How many quarts and pints in .375 gallon?
8. Change .3 day to hours and minutes.
9. Change .625 bushel to pecks and quarts.
10. What part of a gallon is 1 pint?
11. What part of a gallon is 3 pints?

12. What part of a gallon is 1 qt. 1 pt. ?
13. What decimal of a gallon is 1 qt. 1 pt. ?
14. What decimal of a gallon is 2 qt. 1 pt. ?
15. What part of 2 gallons is 2 qt. 1 pt. ?
16. Change .375 bushel to pecks and quarts.
17. What decimal of a bushel is 4 quarts ?
18. What fraction of a day is 3 hr. 20 min. ?
19. Reduce 960 minutes to hours.
20. How many minutes in a day ?

**256. Written Exercises.**

1. What decimal of a ton is 3 pounds ?

Pounds are changed to tons by dividing by 2000.

3 lb. =  $\frac{3}{2000}$  T. = .0015 T. *Ans.*

2. What fraction of an hour is 12 min. 30 sec. ?

$$12 \text{ min. } 30 \text{ sec.} = 12\frac{1}{2} \text{ min.} = \frac{12\frac{1}{2}}{60} \text{ hr.} = \frac{25}{120} \text{ hr.} = \frac{5}{24}$$

3. Reduce  $\frac{1}{8}$  of a day to minutes.

$$\frac{1}{8} \text{ day} = (\frac{1}{8} \times 24) \text{ hr.} = (\frac{1}{8} \times 24 \times \frac{60}{1}) \text{ min.} \text{ Cancel.}$$

4. Reduce .03125 day to minutes.

5. What decimal of a day is 9 minutes ?

6. What will be the cost of 15 T. 500 lb. coal at \$7 per ton ?

7. When coal is \$5 per ton, how many tons and pounds can be bought for \$18.75 ?

8. Change 2 ft. 7 in. to the fraction of a yard.

$$2 \text{ ft. } 7 \text{ in.} = 2\frac{7}{12} \text{ ft.} = \frac{2\frac{7}{12}}{3} \text{ yd.} = \frac{25}{12} \text{ yd.} \text{ } \textit{Ans.}$$

NOTE. — An expression such as  $\frac{2\frac{7}{12}}{3}$  is called a *complex fraction*. It indicates the division of  $2\frac{7}{12}$  by 3 ; that is,  $\frac{25}{12} \times \frac{1}{3}$ , or  $\frac{25}{36}$ .

9. Reduce 3 pk. 4 qt. to the decimal of a bushel.

$$4 \text{ qt.} = .5 \text{ pk.}; 3 \text{ pk.} 4 \text{ qt.} = 3.5 \text{ pk.} = \frac{3.5}{4} \text{ bu.}; \text{etc.}$$

10. How many pecks and quarts in .9375 bushel?

11. If .1875 of a gallon of cologne cost \$ 1.125, what will 1 pint cost?

NOTE.—\$.125 is read 12 cents 5 mills.

12. Find the cost of 42 gal. 3 qt. 1 pt. oil, at 16 cents per gallon.

13. Reduce  $\frac{1}{4}$  of a gallon to quarts and pints.

14. What part of 3 T. is 1 T. 960 lb.?

15. A man raised 194 bu. 1 pk. of rye. He sold 129 bu. 2 pk. What fraction of his crop did he sell?

16. 10 bu. 1 pk. of seed are packed in 8 bags. What quantity is there in each bag?

17. What decimal of a day is 15 hr. 45 min.?

18. How many feet are there in a mile?

### COMPOUND ADDITION.

A compound denominate number expresses two or more denominations of the same kind.

316 T. 1816 lb. is a compound denominate number.

487 T. is a simple denominate number.

*In adding and subtracting compound denominate numbers, write units of the same denomination in the same column.*

257. Add the following:

- |    |                         |                                                |
|----|-------------------------|------------------------------------------------|
| 1. | 18 bu. 3 pk. 7 qt.      | 7 qt. + 4 qt. + 6 qt. = 17 qt. = 2 pk. 1 qt.   |
|    | 9 bu. 2 pk. 4 qt.       | Write 1 qt. and carry 2 pk. 2 pk. + 2 pk.      |
|    | 14 bu. 1 pk. 6 qt.      | + 1 pk. + 2 pk. + 3 pk. = 10 pk. = 2 bu. 2 pk. |
|    | 2 pk.                   | Write 2 pk. and carry 2 bu. 2 bu. + 14 bu.     |
|    | <hr/>                   | + 9 bu. + 18 bu. = 43 bu.                      |
|    | Ans. 43 bu. 2 pk. 1 qt. |                                                |

- |                                                                                                                                             |                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <p>2. 16 yd. 2 ft. 9 in.<br/>          17 yd.       4 in.<br/>              1 ft. 6 in.<br/>              <u>11 in.</u></p>                 | <p>6. 12 T. 1576 lb.<br/>          3 T. 980 lb.<br/>              476 lb.<br/>          <u>1 T. 1830 lb.</u></p>          |
| <p>3. 11 da. 5 hr. 19 min.<br/>          23 da.       40 min.<br/>              17 hr. 50 min.<br/>          <u>5 da. 20 hr. 6 min.</u></p> | <p>7. 2 wk. 5 da. 12 hr.<br/>          6 da. 15 hr.<br/>          5 wk.       2 hr.<br/>          <u>2 da. 19 hr.</u></p> |
| <p>4. 93 gal. 3 qt. 1 pt.<br/>          74 gal.<br/>          18 gal. 1 qt.<br/>              <u>2 qt. 1 pt.</u></p>                        | <p>8. 18 mi. 100 rd.<br/>          34 rd.<br/>          29 mi.<br/>          <u>6 mi. 160 rd.</u></p>                     |
| <p>5. 5 hr. 30 min. 20 sec.<br/>          45 min. 33 sec.<br/>          6 hr. 11 min. 5 sec.<br/>          <u>10 hr. 3 min. 30 sec.</u></p> | <p>9. 47 yr. 11 mo.<br/>          5 yr. 9 mo.<br/>              7 mo.<br/>          <u>22 yr. 5 mo.</u></p>               |
10. 487 T., 316 T. 1816 lb., 247 lb., 43 T. 811 lb., 19 T. 25 lb.  
 11. 83 lb. 15 oz., 9 lb. 5 oz., 18 lb., 22 lb. 11 oz., 5 lb. 8 oz.  
 12. 8 hr. 15 min. 5 sec., 37 min. 52 sec., 5 hr. 48 min., 23 hr.  
 13. 72 gal. 3 qt. 1 pt., 17 gal. 1 qt., 2 qt. 1 pt., 90 gal. 1 pt.  
 14. 7 yd. 2 ft. 11 in., 19 yd. 6 in., 105 yd., 4 yd. 2 ft. 2 in., 1 ft.  
 15. 93 mi. 300 rd., 87 mi. 154 rd., 194 rd., 3 mi. 175 rd., 9 mi.

**COMPOUND SUBTRACTION.****258.** Subtract:

- |                                                          |                                                                                                                                                                        |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. 83 yr. 3 mo.<br/>          <u>15 yr. 9 mo.</u></p> | <p>Change 83 yr. 3 mo. to 82 yr. 15 mo. Subtract 9 months from 15 months. Write the remainder, 6 months, in the column of months. Subtract 15 years from 82 years.</p> |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

*Ans.* 67 yr. 6 mo.

$$\begin{array}{r} 2. \quad 62 \text{ mi. } 84 \text{ rd.} \\ \quad 19 \text{ mi. } 159 \text{ rd.} \\ \hline \end{array}$$

$$\begin{array}{r} 7. \quad 18 \text{ hr. } 5 \text{ min.} \\ \quad \quad 40 \text{ min. } 25 \text{ sec.} \\ \hline \end{array}$$

$$\begin{array}{r} 3. \quad 76 \text{ T. } 225 \text{ lb.} \\ \quad 37 \text{ T. } 1679 \text{ lb.} \\ \hline \end{array}$$

$$\begin{array}{r} 8. \quad 16 \text{ yd. } \quad 9 \text{ in.} \\ \quad \quad 7 \text{ yd. } 1 \text{ ft. } 11 \text{ in.} \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 100 \text{ lb.} \\ \quad 83 \text{ lb. } 4 \text{ oz.} \\ \hline \end{array}$$

$$\begin{array}{r} 9. \quad 100 \text{ bu.} \\ \quad 42 \text{ bu. } 3 \text{ pk. } 7 \text{ qt.} \\ \hline \end{array}$$

$$\begin{array}{r} 5. \quad 52 \text{ wk.} \\ \quad 13 \text{ wk. } 3 \text{ da. } 7 \text{ hr.} \\ \hline \end{array}$$

$$\begin{array}{r} 10. \quad 45 \text{ da. } 1 \text{ hr. } 1 \text{ min.} \\ \quad \quad 6 \text{ da. } 6 \text{ hr. } 6 \text{ min.} \\ \hline \end{array}$$

$$\begin{array}{r} 6. \quad 19 \text{ gal. } \quad 1 \text{ pt.} \\ \quad 8 \text{ gal. } 3 \text{ qt.} \\ \hline \end{array}$$

11. From 27 bu. 1 pk. 5 qt. take 13 bu. 3 pk. 7 qt.

12. From 100 gal. 1 qt. take 83 gal. 2 qt. 1 pt.

13. From 22 hr. 15 min. 20 sec. take 15 hr. 45 min. 40 sec.

14. From 17 lb. 2 oz. take 13 lb. 8 oz.

15. From 100 bu. take 74 bu. 2 pk. 1 qt.

### COMPOUND MULTIPLICATION.

#### 259. Written Exercises.

Multiply 4 gal. 3 qt. 1 pt. by 3.

$$\begin{array}{r} 4 \text{ gal. } 3 \text{ qt. } 1 \text{ pt.} \\ \quad \quad 3 \\ \hline 14 \text{ gal. } 2 \text{ qt. } 1 \text{ pt.} \text{ Ans.} \end{array}$$

3 times 1 pt. = 3 pt. 3 pt. = 1 qt.  
1 pt. Write 1 pint in the column of  
pints. 3 times 3 qt. = 9 qt.; 9 qt. +  
the 1 qt. to carry = 10 qt. 10 qt. =  
2 gal. 2 qt. Write 2 quarts in the  
column of quarts. 3 times 4 gal. =  
12 gal.; 12 gal. + 2 gal. to carry = 14 gal. Ans. 14 gal. 2 qt. 1 pt.

Multiply :

- |                                |                               |
|--------------------------------|-------------------------------|
| 1. 13 bu. 3 pk. 6 qt. by 2.    | 7. 25 lb. 4 oz. by 8.         |
| 2. 25 gal. 2 qt. 1 pt. by 3.   | 8. 33 min. 33 sec. by 9.      |
| 3. 7 lb. 10 oz. by 4.          | 9. 2 pk. 7 qt. by 10.         |
| 4. 23 bu. 3 qt. by 6.          | 10. 3 qt. 1 pt. by 11.        |
| 5. 32 gal. 1 pt. by 7.         | 11. 4 yr. 6 mo. by 12.        |
| 6. 3 hr. 15 min. 15 sec. by 5. | 12. 5 wk. 6 da. 12 hr. by 16. |

## COMPOUND DIVISION.

260. Divide 54 yd. 1 ft. 4 in. by 20.

$$\begin{array}{r} 20 \overline{) 54 \text{ yd. } 1 \text{ ft. } 4 \text{ in.}} \\ \underline{2 \text{ yd. } 2 \text{ ft. } 2 \text{ in.}} \end{array} \text{ Ans.}$$
 54 yd. + 20 gives a quotient of 2 yd., which is written, and a remainder of 14 yd. Reduce 14 yd. to 42 ft., and add 1 ft., making 43 ft. 43 ft. + 20 gives a quotient of 2 ft., which is written, and a remainder of 3 ft. Reduce 3 ft. to 36 in., and add 4 in., making 40 in. 40 in. + 20 gives a quotient of 2 in. which is written.

Divide :

- |                                  |                                  |
|----------------------------------|----------------------------------|
| 1. 13 wk. by 5.                  | 7. 17 lb. 7 oz. by 3.            |
| 2. 15 lb. 9 oz. by 3.            | 8. 37 bu. 3 pk. 6 qt. by 2.      |
| 3. 2 lb. 3 oz. by 5.             | 9. 67 yd. 2 ft. by 4.            |
| 4. 2 gal. 1 qt. by 3.            | 10. 33 da. 15 hr. 57 min. by 3.  |
| 5. 5 bu. by 4.                   | 11. 561 gal. by 6.               |
| 6. 7 hr. by 6.                   | 12. 22 hr. 20 min. 20 sec. by 4. |
| 13. 109 gal. 1 qt. 1 pt. by 7.   |                                  |
| 14. 273 yd. 1 ft. 6 in. by 9.    |                                  |
| 15. 155 bu. 3 pk. 2 qt. by 6.    |                                  |
| 16. 180 da. 19 hr. 28 min. by 8. |                                  |



17. Divide 243 da. 4 hr. 2 min. by 15.

Dividing 243 days by 15 gives a quotient of 16 days and a remainder of 3 days. Reducing 3 days 4 hours to 76 hours and dividing by 15 gives a quotient of 5 hours and a remainder of 1 hour.

Reducing 1 hour 2 minutes to 62 minutes and dividing by 15 gives a quotient of 4 minutes and a remainder of 2 minutes. Reducing 2 minutes to 120 seconds and dividing by 15 gives a quotient of 8 seconds.

$$\begin{array}{r}
 16 \text{ da. } 5 \text{ hr. } 4 \text{ min. } 8 \text{ sec.} \\
 15 \overline{) 243 \text{ da. } 4 \text{ hr. } 2 \text{ min.}} \\
 \underline{15} \\
 93 \text{ da.} \\
 \underline{90 \text{ da.}} \\
 3 \text{ da. } 4 \text{ hr.} \\
 \underline{\quad} \\
 76 \text{ hr.} \\
 \underline{75 \text{ hr.}} \\
 1 \text{ hr. } 2 \text{ min.} \\
 \underline{\quad} \\
 62 \text{ min.} \\
 \underline{60 \text{ min.}} \\
 2 \text{ min.} \\
 \underline{\quad} \\
 120 \text{ sec.} \\
 \underline{120 \text{ sec.}}
 \end{array}$$

18. Divide 334 yd. 9 in. by 21.

$$\begin{array}{r}
 15 \text{ yd. } 2 \text{ ft. } 9 \text{ in.} \\
 21 \overline{) 334 \text{ yd. } 0 \text{ ft. } 9 \text{ in.}} \\
 \underline{21} \\
 124 \text{ yd.} \\
 \underline{105 \text{ yd.}} \\
 19 \text{ yd.} \\
 \underline{\quad} \\
 57 \text{ ft.} \\
 \underline{42 \text{ ft.}} \\
 15 \text{ ft. } 9 \text{ in.} \\
 \underline{\quad} \\
 189 \text{ in.} \\
 \underline{189 \text{ in.}}
 \end{array}$$

Insert the missing denomination, feet, with a cipher prefixed. Reduce the 19 yards remainder to 57 feet. Reduce to 189 inches the 15 feet 9 inches remaining.

19. 825 lb. by 48.

20. 112 T. by 25.

21. 43 mi. by 32.

22. 84 yr. by 24.

23. 462 bu. by 32.

24. 1078 yd. by 63.

25. 288 hr. 9 min. by 54.

26. 863 gal. 2 qt. 1 pt. by 47.

27. 33 wk. 1 da. by 72.

28. 1138 T. 910 lb. by 81.

29. 1629 yd. 1 ft. by 96.

30. 1867 gal.  $1\frac{1}{2}$  pt. by 125.

**261. Avoirdupois Weight. Long Ton.**

In selling iron, coal at the mines, ores, etc., and in calculating the duties at the U. S. custom houses upon imported goods, the following table is used :

28 pounds (lb.)	= 1 quarter (qr.)
4 quarters	= 1 hundredweight (cwt.)
20 hundredweight	= 1 ton (T.)

---


$$1 \text{ cwt.} = 112 \text{ lb.} \quad 1 \text{ T.} = 2240 \text{ lb.}$$

The ton of 2240 pounds is called a *long* ton. Unless otherwise specified in a problem, the cwt. of 100 pounds and the ton of 2000 pounds are to be taken.

**262. Oral Problems.**

1. How many tons and pounds of coal in 40 bags, each containing 80 pounds ?

2. If it takes 3 hr. 20 min. to hoe a row of corn, how long will it take to hoe 3 rows ?

3. A man puts up  $3\frac{1}{2}$  pounds of tea into 4 ounce packages. How many packages does he make ?

4. 3 pk. 3 qt. of apples are divided among 9 children. What quantity does each child receive ?

5. What part of a day is 30 minutes ?

6. If there are  $2\frac{1}{4}$  gallons of wine in 12 bottles, how many pints are there in each bottle ?

7. What is the weight of two packages each containing 15 lb. 11 oz. ?

8. What part of an hour is 40 seconds ?

9. What is the rent of a house for 1 year 9 months at \$16 per month ?

10. If 3 gal. 2 qt. 1 pt. of milk are taken from a can containing 10 gallons, how much is left in the can ?

11. 5 hams weigh  $61\frac{1}{2}$  pounds. What is the average weight?

12. There are on an average 41 pupils in a class. How many are there in 14 classes?

13. At  $37\frac{1}{2}$  cents per yard, how many yards can be bought for \$6.75?

$$\$6\frac{3}{4} \div \$\frac{3}{8} = \frac{27}{1} \div \frac{3}{8} = \frac{27}{1} \times \frac{8}{3} = 72, \text{ etc.}$$

14. Find the cost of 16 barrels of flour at \$6.12 $\frac{1}{2}$  each.

15. \$1.65 is equally divided among 15 boys. What is the share of each?

16. A floor containing  $40\frac{1}{2}$  square yards is 7 yards long. How many yards wide is it?

17. How many ounces in  $5\frac{7}{8}$  pounds?

### 263. Written Problems.

1. If a watch gains 1 min. 17 sec. per day, how much will it gain during March and April?

2. How many bushels, pecks, and quarts in 1449 pounds of corn, weighing 56 pounds to the bushel?

3. Reduce 25 T. 13 cwt. 2 qr. 25 lb. to pounds (long ton).

4. A chain, 97 yd. 8 in. long, contains 1000 links. Find the length of one of the links.

5. A farmer sold out of 5 bushels of peas the following quantities: 3 pk. 6 qt.; 4 pk.; 4 pk. 3 qt.; 1 bu. 1 pk. 1 qt. How much has he still to sell?

6. Change 100,000 pounds to tons (long), cwt., qr., lb.

7. A man walks on Monday 15 mi. 161 rd.; Tuesday, 10 mi. 84 rd.; Wednesday, 19 mi. 15 rd.; Thursday and Friday, 12 mi. 121 rd. each day; Saturday, 14 mi. 240 rd. What distance per day does he average?

8. If the sun rises at 5 hr. 10 min. A.M., and sets at 6 hr. 42 min. P.M., how long is the day? How many hours and minutes of night?

9. Find the duty at  $1\frac{1}{10}\%$  per pound on an invoice of tin weighing 33 T. 7 cwt. 20 lb. (long ton).

10. An iron rod is 12 ft. 6 in. long. From it are cut 73 bolts, each  $1\frac{1}{4}$  inches long. How much is left?

11. A man rows a mile in 10 min. 30 sec. How long would he take to row 27 miles at the same rate?

12. What is the total weight in tons (long), etc., of 19 barrels of soda-ash weighing 13 cwt. 2 qr. 10 lb. each?

13. A man rows 51 miles in 23 hr. 5 min. and 30 sec. How long does he take to row a mile?

14. If I lost \$50 by selling a lot for two-thirds of its cost, what would I have lost if I had sold it for three-fourths of its cost?

15. At the rate of \$2.75 per day of 8 hours, how much should be given a man that works from a quarter before 8 in the morning until 5 minutes past 11 in the morning?

16. If a railroad train travels 18 miles in 40 minutes, how far will it travel, at the same rate, in  $7\frac{1}{2}$  hours?

17. A coal dealer buys 175 (long) tons of coal. How much does he receive for it at \$5 per ton of 2000 pounds?

#### TIME BETWEEN DATES.

##### 264. Oral Problems.

1. How many hours from 3 o'clock Saturday afternoon to 9 o'clock Sunday morning?

2. How many days from May 1 to June 1?

3. A boy takes a spoonful of medicine every hour. If he takes the first dose at 2 o'clock, at what hour will he take the sixth? The second? The fourth?

4. A man begins work on the morning of the 6th and ends on the evening of the 11th. How much does he earn at \$3 per day?

5. An importer receives some cases of goods numbered consecutively. How many cases are there if the lowest number is 29 and the highest number is 53?

6. How many posts 6 feet apart will be needed for a fence 120 feet long. For a fence 6 feet long? 12 feet long?

7. Find the time from Jan. 1 to Jan. 31, counting the first and the last day. Omitting both days.

8. How many days from July 4 to Aug. 15, inclusive?

9. How many chapters from the 25th to the 49th, exclusive?

10. A girl begins at the 146th problem and solves all those on two pages. If the last is the 172d problem, how many does she solve?

265. How many days from March 4 to Sept. 1?

March 4 to March 31, 27 days	
Excluding March 4, there remain	April 30
in the month $31 - 4$ , or 27 days. To	May 31
this add the number of days in April,	June 30
May, June, July, and August. Since	July 31
March 4 is excluded, we take 1 day	Aug. 31
in September, making the total 181	Sept. 1
days.	

*Ans.* 181 days

*In finding the time between dates, either the first or the last day is excluded; that is, from the 1st to the 21st is considered 20 days.*

**266. How many days from**

- |                           |                         |
|---------------------------|-------------------------|
| 11. Jan. 1 to Feb. 19?    | 16. Feb. 29 to April 1? |
| 12. Oct. 31 to Dec. 30?   | 17. May 21 to July 4?   |
| 13. Sept. 30 to Dec. 16?  | 18. April 7 to May 27?  |
| 14. Nov. 1 to Dec. 19?    | 19. June 10 to Aug. 1?  |
| 15. March 16 to April 25? | 20. July 4 to Sept. 1?  |

**267. Written Problems.**

Take note of leap year.

How many days from :

1. Feb. 6, 1903, to Oct. 1, 1903?
2. Oct. 14, 1903, to March 3, 1904?
3. Jan. 1, 1904, to April 19, 1904?
4. Dec. 23, 1904, to March 8, 1905?
5. Sept. 3, 1903, to Feb. 1, 1904?
6. March 16, 1904, to Dec. 25, 1904?
7. June 3, 1905, to Nov. 29, 1905?
8. Aug. 17, 1903, to Jan. 3, 1904?
9. April 4, 1905, to July 4, 1905?
10. May 16, 1906, to Oct. 14, 1906?
11. How much wages at \$4 per day should a man receive from Tuesday, Jan. 2, 1906, to Feb. 28, inclusive, no pay to be received for Sundays or legal holidays?
12. A man borrowed \$100 April 4, and returned it Nov. 25. How many days' interest did he owe? (Do not include both days.)
13. May 1, 1903, fell on Friday. Upon what day of the week did July 4 fall?

14. How many days does vacation last if it begins on the morning of Saturday, July 2, and school commences on the first Tuesday of September?

15. A man borrows some money June 16, and agrees to return it in 60 days. On what date should he pay it?

16. A traveller starts upon a trip Aug. 24, 1904, and reaches home again Feb. 10, 1905. How long is he away?

In each of the preceding examples the difference between the dates is less than a year, and the answer is required in days. When the difference is more than a year, it is generally obtained by compound subtraction, each month being considered as containing 30 days.

17. Find the difference in time between March 3, 1891, and Jan. 1, 1905.

	1905	1	1
Writing 1905, 1st month, 1st day, we subtract	1891	3	3
1891, 3d month, 3d day. <i>Ans.</i> 13 yr. 9 mo. 28 da.	13	9	28

18. George Washington was born Feb. 22, 1732. How old was he at the signing of the Declaration of Independence, July 4, 1776?

19. Abraham Lincoln was first inaugurated president March 4, 1861. How long had he served at his death, April 15, 1865?

20. The battle of Lexington took place April 19, 1775. The treaty of peace was signed Sept. 3, 1783. How many years, months, and days between the two events?

21. How many years elapsed between the discovery of America by Columbus, Oct. 12, 1492, and the landing of the Pilgrims, Dec. 21, 1620?

22. General Harrison fought the battle of Tippecanoe Nov. 7, 1811. He was inaugurated president 29 yr. 3 mo. 27 da. later. Give the date of his inauguration.

23. How long was it after the treaty with England, signed Dec. 24, 1814, that the Mexican treaty was concluded, Feb. 2, 1848?

24. General Taylor died July 9, 1850. How long did he live after the capture of Monterey, Sept. 24, 1846?

25. President Garfield was born Nov. 19, 1831. How old was he at his inauguration, March 4, 1881?

26. The last battle of the Mexican War took place Sept. 14, 1847. The battle of Bull Run was fought 13 yr. 10 mo. 7 da. later. What was the date of this battle?

27. Find the time between July 4, 1776, and Jan. 1, 1904.

PERCENTAGE.

268. Oral Exercises.

- |                      |                                |
|----------------------|--------------------------------|
| 1. Find 4% of \$125. | 6. $33\frac{1}{3}\%$ of 1 day. |
| 2. 25% of 16.        | 7. $62\frac{1}{2}\%$ of \$12.  |
| 3. 6% of 200 cows.   | 8. 9 % of \$23.                |
| 4. 1% of 150 pounds. | 9. 75 % of 3 gallons.          |
| 5. 20% of 65 yards.  | 10. $1\frac{1}{4}\%$ of \$400. |

269. Written Exercises.

- |                                            |                                             |
|--------------------------------------------|---------------------------------------------|
| 1. Find 6% of \$576.<br>\$576 $\times$ .06 | 9. 25 % of \$156.<br>$\frac{1}{4}$ of \$156 |
| 2. $4\frac{1}{2}\%$ of \$340.              | 10. 1 % of \$156.                           |
| 3. 25 % of 1876 bushels.                   | 11. $\frac{1}{4}\%$ of \$156.               |
| 4. $12\frac{1}{2}\%$ of 864 cows.          | 12. 50 % of 480 hours.                      |
| 5. 50 % of 432 yards.                      | 13. $\frac{1}{2}\%$ of 480 hours.           |
| 6. $33\frac{1}{3}\%$ of 576 soldiers.      | 14. $\frac{1}{3}\%$ of \$1420.              |
| 7. $16\frac{2}{3}\%$ of 696 gallons.       | 15. $3\frac{1}{3}\%$ of \$66.               |
| 8. $6\frac{1}{4}\%$ of \$4.96.             | 16. $7\frac{1}{2}\%$ of 360 days.           |



**INTEREST.**

**270.** *Interest* is the sum paid for the use of money.

The *Principal* is the sum loaned.

The *Amount* is the sum of the principal and interest.

*In computing interest, the year is considered as composed of 12 months of 30 days each.*

**271. Oral Exercises.**

Find the interest on:

1. \$90 for 2 months at 4%.
2. \$60 for 60 days at 6%.
3. \$100 for 2 yr. 6 mo. at 5%.
4. \$120 for 30 days at 5%.
5. \$300 for 90 days at 3%.
6. \$100 for 1 yr. 3 mo. at 4%.
7. \$50 for 3 years at 6%.
8. \$100 for 2 yr. 4 mo. at 6%.

**272.** Find the interest on \$63 for 4 yr. 5 mo. at 5%.

Find the interest for one year by multiplying the principal, \$63, by the rate, 5, expressed as hundredths. Multiply this product, \$3.15, by the time expressed in years,  $4\frac{5}{12}$ .

$$\begin{array}{r}
 \$63. \\
 .05 \\
 \hline
 \$3.15 \\
 4\frac{5}{12} \\
 12) \$15.75 \\
 \underline{\$1.31} + \\
 12.60 \\
 \hline
 \text{Ans. } \$13.91
 \end{array}$$

\$63 is called the principal.

5 = rate.

4 yr. 5 mo. = time.

$$\text{Interest} = \text{Principal} \times \frac{\text{Rate}}{100} \times \text{Time (in years).}$$

The work may sometimes be shortened by indicating the operations and cancelling:

$$\begin{array}{c} \$ .21 \\ \$ \cancel{63} \times \frac{5}{\cancel{100}} \times \frac{53}{\cancel{12}} = \frac{\$ 55.65}{4} = \$ 13.91 +. \end{array}$$

Find the interest on \$160.50 for 3 mo. 15 da. at 6%.

$$\begin{array}{c} \$ 1.605 \\ \$ \cancel{160.50} \times \frac{6}{\cancel{100}} \times \frac{7}{\cancel{24}} = \frac{\$ 11.235}{4} = \$ 2.808 + \quad \text{Ans. } \$ 2.81. \end{array}$$

NOTE. — The divisor, 100, should be cancelled only in performing the final division.

Find the interest on \$69.75 for 1 mo. 17 da. at 4%.

$$\begin{array}{c} \$ .007475 \\ \$ \cancel{69.75} \times \frac{4}{\cancel{100}} \times \frac{47}{\cancel{360}} = \$ .36425. \quad \text{Ans. } 36 \text{ cents.} \end{array}$$

NOTE. — The three ciphers in the dividend are cancelled by moving the decimal point in the dividend three places to the left, prefixing a decimal cipher.

### 273. Written Exercises.

Find the interest on:

1. \$192 for 3 yr. 7 mo. at 5%.
2. \$60 for 2 mo. 12 da. at 4%.
3. \$240 for 1 yr. 1 mo. at 6%.
4. \$14.40 for 5 yr. 5 mo. at 5%.
5. \$36 for 77 days at  $4\frac{1}{2}\%$ .
6. \$99 for 21 months at 6%.
7. \$192 for 2 yr. 4 mo. at 5%.
8. \$600 from Jan. 1 to Jan. 16 at 4%.
9. \$1200 from July 1, 1903, to Jan. 1, 1905, at 6%.
10. \$57.60 from Oct. 4, 1904, to Feb. 4, 1908, at 5%.

**274. Oral Problems.**

1. 16 is how many hundredths of 64?

2. What per cent of 25 is 5?

3. What part of  $\frac{4}{5}$  is  $\frac{3}{5}$ ?

Change both to the same denominator: 16 twentieths, 15 twentieths.

4. What part of 2 lb. 1 oz. is 1 lb.?

Change both to the same denomination: 33 oz., 16 oz.

5. Divide 4 gallons by 3 pints.

6. How many pencils at 4 mills each can be bought for a dollar?  
1 mill =  $\frac{1}{10}$  of a cent.

7. Write  $\frac{1}{10}$  as a decimal.

8. Divide 34 by 200.

9. How many pounds in one-quarter of a ton? How many pints in .25 of a bushel?

10. Change  $37\frac{1}{2}\%$ , 75%,  $8\frac{1}{3}\%$ ,  $62\frac{1}{2}\%$ ,  $6\frac{1}{4}\%$ , to fractions of a dollar?

11. How many pounds of cheese at \$0.16 $\frac{2}{3}$  a pound can be bought for \$5.00?

12. An agent collected rents amounting to \$300. What was his commission at  $\frac{1}{2}\%$ ?

13. Find the interest of \$200 for 1 yr. 3 mo. at 4%.

14. A farmer raised 50 bushels of cranberries, and sold 60% of them. How many bushels did he sell?

15. What % of a number is  $\frac{2}{10}$  of it?

16. What would 42 pounds of butter cost at  $33\frac{1}{3}\%$  a pound?

17. When the tax rate is \$12 per \$1000, what will Mr. Smith's tax be if he owns \$4500 worth of property?

18. A man pays \$60 interest per year. How much interest does he pay in 3 yr. 7 mo.?

19. At \$45 per month, what is the rent of a house for 2 yr. 7 mo.?

20. Express in per cents:  $\frac{1}{2}$ ;  $\frac{1}{3}$ ;  $\frac{1}{4}$ ;  $\frac{1}{5}$ ;  $\frac{1}{6}$ .

**275. Written Problems.**

1. What is the interest on \$760 for 5 months at  $3\frac{1}{2}\%$ ?

2. A merchant insures property worth \$20,000 for  $\frac{3}{4}$  of its value. How much does he pay, the rate for insuring being  $1\frac{1}{4}\%$ ?

3. What is the commission on \$5678 worth of cloth at  $2\frac{1}{2}\%$ ?

4. At  $3\%$ , what is the commission on the sale of 5000 pounds of sugar at  $5\frac{1}{4}\phi$  per pound?

5. What will be the interest on \$720 for 3 mo. 24 da. at  $4\frac{1}{2}\%$ ?

6. A clerk's income is \$800. He pays  $25\%$  of it for board, and  $33\frac{1}{3}\%$  of the remainder for clothes. How much has he left?

7.  $\frac{1}{4}\%$  of my money is in my pocket,  $38\%$  is in the bank, and the rest is in real estate. I have in all \$24,000. How much is in the bank and in real estate?

8. An auctioneer sold for Mrs. Paul, on  $10\%$  commission, 14 chairs at \$1.75, 6 tables at \$2.75, 40 yards carpet at  $62\frac{1}{2}\phi$  a yard, and a miscellaneous lot for \$119.24. What sum did Mrs. Paul receive after paying commission?

9. How many feet in  $62\frac{1}{2}\%$  of a mile?

What part of a day is 18 hr. 30 min.?

Reduce 9 cwt. 17 lb. to ounces.

10. If .625 of a cord of wood costs \$3.75, what will .75 of a cord cost?

11. A business man's receipts for a week are \$2575. His average rate of profit is 5% of his receipts. What is his profit for the week?

12. A certain city had 14,250 inhabitants in 1900. The population has increased 24 per cent. What is the present number of inhabitants?

13. A class has 56 pupils on register. When  $14\frac{1}{2}$  per cent of the pupils are absent, how many are present?

14. A merchant's sales for 1903 were \$45,276. What should be the sales for 1904 to make an increase of  $16\frac{1}{2}$  per cent?

15. Thirty words were dictated as a spelling test. One pupil received a mark of  $93\frac{1}{2}$  per cent. How many words did he misspell?

16. A certain regiment went into battle with 1000 men. Of these 5% were killed, 12% were wounded, 3% were taken prisoners, and 1% were missing. How many remained available for duty?

17. What is the duty at 35 cents per square yard on a piece of cloth measuring 56 yards, 27 inches wide?

18. A man bought a bill of goods amounting to \$374.50, with a deduction of 2% for payment within 10 days. How much does he save by paying the bill within the 10 days?

19. A merchant places a bill of \$840 in the hands of a collector, who collects 75% of the amount. How much does the merchant receive if the collector deducts 5% of the amount collected, as his commission?

20. How many pounds of bread can be made from 5 bushels of wheat weighing 60 pounds per bushel, if the wheat loses 30 per cent in the process of grinding into flour, and if the bread weighs  $33\frac{1}{2}$  per cent more than the weight of the flour used?

## SURFACES.

## 276. Preliminary Exercises.

1. What is the length in inches of a row of four envelopes, each five inches long, placed end to end? What is the length in feet and inches.

5 inches			
3 inches			

2. What is the width in inches of four such rows, each envelope three inches wide, just touching each other? What is the width in feet?

3. How many envelopes are there? How many square inches are there in each envelope? How many square inches are covered by all of them?

4. How many envelopes 5 inches by 3 inches would cover the top of a table 4 ft. 2 in. long and 2 ft. 6 in. wide?

5. Draw a rectangle to represent a floor 24 feet long 18 feet wide. Draw rugs 6 feet long, 3 feet wide, and see how many will be needed to cover the floor.

6. What is the difference between three square inches and three inches square?

7. What is the distance around a room that is 40 feet by 30 feet?

8. A garden is 12 feet long and 9 feet wide. How many bunches of flowers will it furnish, if it takes 3 square feet to furnish one bunch?

9. A room is 36 feet long and 30 feet wide. How many square yards in the floor?

10. How many yards is it around a room 15 feet long and 12 feet wide?

11. How many square inches in the surface of a sheet of paper 1 foot 8 inches long, 11 inches wide?

12. How many pieces of paper 2 inches square will exactly cover a slate 12 inches long, 8 inches wide?

### 277. Written Problems.

1. How many boards 12 feet long, 6 inches wide will be required for a floor 8 yards long, 6 yards wide?

The floor is 24 feet long, 18 feet wide; its area in square feet is  $18 \times 24$ . The area of the board in square feet is  $12 \times \frac{1}{2}$ , or 6.

$$\text{Number of boards} = \frac{18 \times 24}{6}$$

NOTE.—Labor is frequently saved in examples involving multiplication and division by first indicating the operations and then using cancellation.

2. How many bricks 8 inches by 4 inches will be needed for a walk 24 yards long, 6 feet wide, making no allowance for waste?

Area of top surface of one brick =  $(8 \times 4)$  square inches. The length of the walk in inches =  $24 \times 3 \times 12$ ; width in inches =  $6 \times 12$ . Area of walk in square inches =  $24 \times 3 \times 12 \times 6 \times 12$ . Divide this by  $8 \times 4$ , the number of square inches in the top surface of a brick.

$$\text{Number of bricks} = \frac{24 \times 3 \times 12 \times 6 \times 12}{8 \times 4}$$

NOTE.—It will be remembered that the divisor and the dividend must be of the same denomination, square inches in this example.

3. How many paving tiles  $\frac{1}{2}$  foot square will cover a hearth 6 feet long, 3 feet wide?

Make a diagram.

4. How many boards 12 feet long, 8 inches wide will be required for a close fence 120 yards long, 6 feet high?

5. Find the number of paving stones 9 inches by 3 inches, in a street 100 rods long, 10 yards wide.

6. Draw a rectangle 2 inches by 3 inches. Draw one twice the size. What are the dimensions of the latter? What are the dimensions of one four times the size?

A plot 100 feet by 100 feet is how many times as large as a plot 25 feet by 25?

7. A brick is 8 inches long, 4 inches wide, 2 inches thick. How many square inches are there in the surface of the widest face? In the surface of one side? In the surface of one end?

8. How many bricks laid on the widest face will be needed for a walk 288 inches long, 96 inches wide?

9. How many bricks laid on the side will be needed for a walk 24 feet long, 8 feet wide?

10. How many square feet are there in a roll of wall paper 24 feet long, 18 inches wide?

11. How many rolls 24 feet long,  $1\frac{1}{2}$  feet wide, would be required to paper the ceiling of a room 45 feet long, 36 feet wide, making no allowance for matching or waste?

12. The owner of a piece of ground 200 feet wide, 300 feet long, divides it into lots 25 feet by 100 feet. How many lots are there?



**13. Make table of square measure :**

square inches (sq. in.)	= 1 square foot (sq. ft.)
square feet	= 1 square yard (sq. yd.)
square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre (A.)
acres	= 1 square mile (sq. mi.)

**14.** There are 160 square rods in an acre. How many square yards are there in an acre?

**15.** Give the dimensions, in yards, of a field that will contain just an acre. Of one that will contain two acres.

**16.** At \$80 per acre what is the value of a field 80 rods long, 70 rods wide?

What will it cost to fence the field at 20¢ per running yard?

**17.** A man has a lot 100 feet by 200 feet. How many square feet will he have left for a garden after he builds a house 25 feet by 60 feet?

**18.** One wall of a room is 24 feet long and 12 feet high. There is a door in it 8 feet high,  $4\frac{1}{2}$  feet wide. How many square yards of plastering will be needed to cover the wall?

**19.** What would be the cost of painting 1800 feet of fence 6 feet high at 15 cents per square yard?

**20.** What is the length of a rectangular field 60 rods wide that contains 60 acres?

**21.** A farm is one mile square. How many 40-acre fields does it contain?

**22.** How many acres in a field in the shape of a triangle whose base and perpendicular measure 40 rods each?

**23.** How many acres are there in a triangular plot of ground when the base measures 80 yards and the perpendicular measures  $60\frac{1}{2}$  yards?

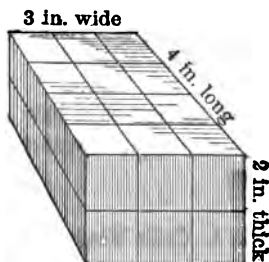
## VOLUMES.

## 278. Preliminary Exercises.

1. How many one-inch cubes can be placed on the bottom of a box 4 inches long, 3 inches wide?

2. If the box is one inch high, how many will it hold? If the box is 2 inches high? 3 inches high?

NOTE. — A cube one inch long, one inch wide, one inch high, contains a cubic inch.



3. How many cubic inches in a box 3 inches long, 4 inches wide, 1 inch high? In a box 3 inches long, 4 inches wide, 2 inches high? In a box 4 inches long, 4 inches wide, 4 inches high?

4. If you had 24 one-inch cubes, how could you pile them to make a solid with six rectangular faces?

5. If the pile was 2 inches high, how many cubes would there be in each tier? How many square inches would the lower tier cover?

6. How could the 24 cubes be arranged to make a pile 3 inches high?

7. Can you give a rule for finding the number of cubic inches in a box 4 inches long, 2 inches high, 3 inches wide?

8. How many cubic inches of water would a tin box hold, the dimensions of the box being 5 inches by  $3\frac{1}{2}$  inches by 4 inches?

9. How many one-foot cubes could be placed in a cubical box one yard long, one yard wide, one yard high?

**279.** A solid has three dimensions: length, breadth, and thickness.

The *volume* or contents of a solid, is the space it occupies, expressed in cubic inches, cubic feet, cubic yards, etc.

A *cube* is a solid having six equal square faces.



**280. Cubic Measure.**

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)

27 cubic feet = 1 cubic yard (cu. yd.)

**281. Written Exercises.**

1. How many cubic inches in a solid 3 yards long, 2 feet wide, 6 inches high? How many cubic feet? How many cubic yards?

To find the volume in cubic inches, change 3 yards to 108 inches, and 2 feet to 24 inches.

Volume =  $(108 \times 24 \times 6)$  cubic inches.

Volume (in cubic feet) =  $(9 \times 2 \times \frac{1}{2})$  cubic feet.

Volume (in cubic yards) =  $(3 \times \frac{2}{3} \times \frac{1}{3})$  cubic yards.

2. How many cubic feet of air in a room 24 feet long, 18 feet wide, 12 feet high?

3. Find the solid contents of a piece of timber 25 feet long, 3 feet wide, 5 feet thick. Is it larger or smaller than a piece 4 feet wide, 4 feet thick, and 23 ft. 6 in. long?

4. How many cubic yards of earth will have to be removed in digging a cellar 18 feet wide, 55 feet long, 6 feet deep? What will be the cost at 60¢ a load (1 cubic yard)?

5. A brick is 8 inches long, 4 inches wide, 2 inches thick. How many bricks are there in a pile 60 feet long, 20 feet wide, 5 feet high?

6. Find the number of bricks in a wall 24 feet wide, 48 feet high, 1 foot thick, making no allowance for mortar, etc.

7. How many bricks are there to a cubic foot?

8. Allowing 20 bricks to a cubic foot when laid in mortar, how many bricks will be needed for a wall 24 feet wide, 50 feet high, 20 inches thick?

9. What will be the cost of building a stone wall 40 rods long, 4 feet high, 1 yard thick, at \$6.40 per perch of  $24\frac{1}{4}$  cubic feet?

10. A cord of wood contains 128 cubic feet. If the wood is cut into 4-foot lengths, what should be the other two dimensions of a regular pile to hold just a cord?

11. How many cords of wood are there in a pile 24 feet long, 4 feet wide, 12 feet high?

1 cord = 128 cubic feet.

### 282. Cubic Measure of Capacity.

231 cu. in. = 1 gallon

2150.4 cu. in. = 1 bushel

128 cu. ft. = 1 cord

12. Find the capacity in bushels of a bin 1 yd. long, 2 ft. 4 in. wide, 5 ft. 4 in. high.



The *capacity* of a bin, tank, etc., corresponds to the *volume* of the contents of the bin or tank when full.

Write the dimensions in inches as factors, with the number of cubic inches in a bushel as a divisor, and cancel.

$$\begin{array}{r} 3 \quad 4 \quad 10 \\ \cancel{88} \times \cancel{28} \times \cancel{64} \cancel{0} \text{ bu.} = 30 \text{ bu. } \textit{Ans.} \\ \hline 21504 \cancel{4} \\ 1792 \\ 256 \\ 64 \end{array}$$

The decimal point in the divisor is moved one place to the right, and a cipher is added to one of the numbers above the line. 21504 is cancelled by 12, 7, 4, and 64.

13. Find the capacity in gallons of a tank 1 ft. 9 in. long, 1 ft. 3 in. wide, 1 ft. 10 in. deep.

$$\frac{21 \times 15 \times 22}{231} \text{ gal. Cancel.}$$

14. How many gallons are there in a cubic foot?

Give the answer as a mixed number; as a mixed decimal.

15. How many cubic feet are there in a bushel?

Give the answer as a mixed number; as a mixed decimal.

16. Give the width of a wagon body 18 inches high, 6 feet long, that will hold, when full, a cubic yard.

17. A gallon contains 231 cu. in. Give the dimensions of a tin box that will hold exactly a gallon.

18. A pile of wood 40 feet long and 12 feet wide contains 1920 cubic feet. How high is it?

19. How much will it cost to have it cut if it costs 80 cents a cord?

20. A pile of 4-foot wood is 16 feet long and 6 feet high. Required the cost at \$ 5.50 per cord.

21. A rectangular tank is 5 feet long, 2 feet wide, and 2 feet deep. How many gallons of water will it hold?

22. What is the cost of digging a cellar 21 feet long, 18 feet wide, and 6 feet deep, at \$.28 a cubic yard?

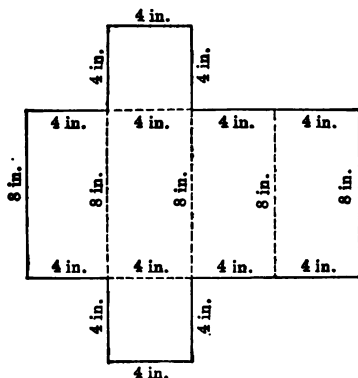
23. How much will a block of granite weigh 15 feet long, 12 feet wide, and 9 feet thick, if 9 cubic feet weigh 72 lb.?

### SURFACES OF RECTANGULAR SOLIDS.

#### 283. Preliminary Exercises.

1. How many faces has a cube?
2. What is the surface of each face of an inch cube?
3. How many square inches are there in all the faces of an inch cube?

The accompanying diagram shows the dimensions of a piece of paper that will exactly cover a square prism, whose base measures 4 inches by 4 inches, and whose height is 8 inches.



4. How many square inches are there in the top face of the prism? In the bottom face? In each of the four side faces? In the four side faces? In the two ends? In the entire surface?

**284. Written Exercises.**

1. Make a diagram of a piece of paper that when folded will just cover the six faces of a brick  $8 \times 4 \times 2$  inches. How many square inches of paper would be needed?

2. The owner of a piece of ground 600 feet long, 150 feet wide, builds a fence 6 feet high around the plot. How many square feet of fence are there?

The surface of this fence may be considered as the four side faces of a solid. The area in square feet =  $(150 \times 6) + (600 \times 6) + (150 \times 6) + (600 \times 6)$ . The operation is shortened by adding 150, 600, 150, and 600, and multiplying the sum by 6.  $(1500 \times 6)$  sq. ft. = 9000 sq. ft., *Ans.*

3. A room is 24 feet long, 18 feet wide, 12 feet high. Draw, touching each other, four rectangles representing the four walls. Write the dimensions of each wall.

What are the dimensions of the large rectangle made up of the four smaller ones? Give the area in square feet. In square yards.

4. Show by a diagram the shape of a piece of paper that when folded will entirely cover a box 12 inches long, 6 inches wide, 4 inches high. Write the dimensions.

This is called the "development" of the box.

What is the area of the paper in square inches?

5. How many square feet are there in a fence 10 feet high enclosing a lot 250 feet long, 200 feet wide?

6. Make a diagram of a room 24 feet long, 18 feet wide, 12 feet high, showing the surface that is generally plastered.

How many square yards of plaster will be needed for the above room, making no allowance for doors, windows, etc.?

7. A box is 4 inches long, 2 inches wide, and 2 inches deep. How many square inches on its surface? With the pen, sketch a free-hand development of this box.

8. One of the drawing models is a square prism 8 inches long and 4 inches square. How many square inches on the whole surface of the model?

9. How many square yards in the walls of a room 12 feet wide, 15 feet long, and 9 feet high?

10. The floor of a room is  $18\frac{1}{2}$  feet long,  $15\frac{1}{2}$  feet wide. How many square yards in the ceiling?

A lot of land containing 5250 square feet is 125 feet long. How wide is it?

### ANGLES, TRIANGLES, QUADRILATERALS.

285. The following may be drawn free-hand, the compasses being reserved for the geometrical problems in Chapter VIII.

1. Draw two lines meeting at a point.

These lines make an *angle*.

2. Draw two lines that will make four angles.

3. Draw two lines so as to make two angles.

Two such angles are called *supplementary* angles.

4. Make two equal supplementary angles.

Equal supplementary angles are called *right* angles. A line making a right angle with another line is said to be *perpendicular* to it.

5. Draw two lines so as to make one right angle.

Is the right angle made by two lines, each 10 feet long, any larger than a right angle made by two lines, each 1 inch long?

6. What is the smallest number of straight lines that will enclose space?

Draw a figure enclosed by the smallest possible number of straight lines. What is its name? Why?

7. Make a triangle having one right angle.



8. Can you draw a triangle having two right angles? Why? What name is given to lines that will not meet, no matter how far they are extended?

9. An angle less than a right angle is called an acute angle.

Draw a triangle containing an acute angle.

10. Can you draw a triangle containing two acute angles? Three acute angles?

11. An angle greater than a right angle is called an obtuse angle.

Draw a triangle containing an obtuse angle.

12. Can you draw a triangle containing three obtuse angles? Containing two?

13. Draw a triangle with sides 2 inches, 3 inches, 4 inches, respectively.

A triangle having no two sides equal is called a *scalene* triangle.

14. Draw a triangle having two equal sides.

This is called an *isosceles* triangle. The unequal side is called the base.

15. Draw an isosceles triangle with the base uppermost. With the base on the left. On the right.

16. Draw a triangle having three equal sides (an equilateral triangle).

17. Draw a square. Draw a rectangle 4 inches by 3 inches.

How many right angles in each?

18. Draw a four-sided figure having its opposite sides parallel, but containing no right angle (rhomboid).

What kinds of angles does it contain? How many of each? Write name in each angle.

19. Draw a four-sided figure, having all its sides equal, but containing no right angle (rhombus).

20. Draw a quadrilateral (four-sided figure) having only two parallel sides (trapezoid).

21. Draw a quadrilateral having no parallel sides (trapezium).

22. Draw a rhombus, each side 2 inches. A square, each side 2 inches.

What is the difference between them? Which is larger?

23. A parallelogram is a quadrilateral that has its opposite sides parallel.

Name the parallelograms that have four equal sides (equilateral). Those that have four equal angles (equiangular).

24. The height of a parallelogram is called its altitude. Draw a rectangle, base  $3\frac{1}{2}$  inches, altitude  $2\frac{1}{2}$  inches. Draw a rhomboid, base  $3\frac{1}{2}$  inches, altitude  $2\frac{1}{2}$  inches. Draw several rhomboids of the above dimensions, all differing in shape.

25. Cut out of paper a rectangle, base 3 inches, altitude 2 inches. Cut out a rhomboid, base 3 inches, altitude 2 inches. Place one upon the other, and see how their areas compare.

26. Can you calculate the number of square inches in a rhomboid whose base is 3 inches and altitude 2 inches?

27. Draw a rectangle, base 4 inches, altitude 3 inches. Divide by a diagonal into two triangles. Mark in each triangle its area.

28. Draw a right-angled triangle, base 4 inches, perpendicular (altitude) 3 inches. Calculate its area.

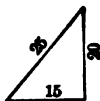
29. Draw a rectangle, base 4 inches, altitude 3 inches. From the middle point of the upper base draw lines to the extremities of the lower base, making three triangles. Mark in each triangle its area.

30. Draw an isosceles triangle, base 4 inches, altitude 3 inches, and calculate its area.

**286. Areas of Triangles and Quadrilaterals.**

Find the areas of the following:

1. A right-angled triangle whose sides measure 15, 20, and 25 inches respectively.



NOTE. — Area of triangle =  $\frac{1}{2}$  product of base by altitude (perpendicular).

2. A right-angled triangle whose base measures 64 yards, perpendicular 48 yards.

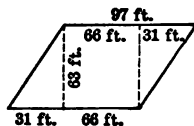
3. A triangle whose base measures 18 rods, altitude 13 rods.

4. A square whose side measures 35 feet.

Area of parallelogram = base  $\times$  altitude.

5. A rectangle 42 yards by 37 yards.

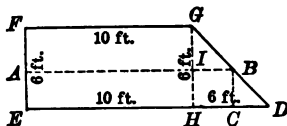
6. A rhombus whose base is 97 feet, altitude 63 feet.



Show that the area of this parallelogram is equal to that of a rectangle 97 feet by 63 feet.

7. A rhomboid, base 33 meters, altitude 28 meters.

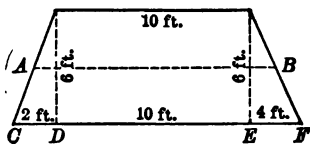
8. A trapezoid whose parallel sides measure 10 and 16 feet, respectively, the perpendicular distance between them being 6 feet.



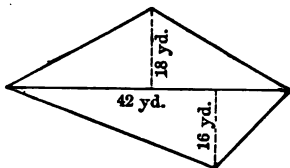
Draw this trapezoid on a scale of  $\frac{1}{4}$  inch to the foot, and measure  $AB$ , which divides the rectangle  $EFGH$  into two equal parts.  $AB = \frac{1}{2}(FG + ED)$ . Cut off the triangle  $BCD$  and add it to the upper half of the trapezoid, so that  $CD$  will be a continuation of  $FG$ . The rectangle thus formed should measure 13 feet by 6 feet.

9. A trapezoid as shown in the accompanying diagram.

Draw to a scale; cut off a triangle from  $A$  to the centre of  $CD$ , also one from  $B$  to the centre of  $EF$ ; and place these triangles above  $AB$ , so as to make a rectangle,  $\frac{1}{2}(10 + 16)$  feet long and 6 feet wide.



10. A trapezium, one of whose diagonals measures 42 yards, the perpendiculars to the opposite corners measuring 18 yards and 16 yards, respectively.



Area in square yards =  $(42 \times \frac{1}{2} \text{ of } 18) + (42 \times \frac{1}{2} \text{ of } 16) = 42 \times \frac{1}{2} \text{ of } (18 + 16)$ .

### SPECIAL DRILLS. — REVIEW.

#### 287. Oral Exercises.

1.  $463 + 157 = 463 + 100 + 50 + 7 =$

In giving the solution at sight, the pupil says (or thinks) 563, 618, 690.

2.  $256 + 184$

4.  $185 + 546$

6.  $167 + 734$

3.  $419 + 342$

5.  $668 + 193$

7.  $476 + 155$

8.  $4170 + 470 = 4170 + 400 + 70$

Use no unnecessary words: 4570, 4640.

9.  $1260 + 850$

11.  $3450 + 390$

13.  $5620 + 590$

10.  $2140 + 680$

12.  $4370 + 280$

14.  $6380 + 660$

15.  $400 - 163 = 400 - 100 - 60 - 3 =$

Say only 300, 240, 237.

16.  $501 - 375$       18.  $650 - 488$       20.  $361 - 149$   
 17.  $275 - 137$       19.  $540 - 384$       21.  $455 - 358$   
 22.  $7310 - 6850 = 7310 - 6800 - 50 =$   
     510, 400.  
 23.  $8610 - 7680$       25.  $4960 - 4380$       27.  $6450 - 5760$   
 24.  $5000 - 4670$       26.  $2770 - 1890$       28.  $7320 - 6560$   
 29.  $24 \times 66\frac{2}{3} = \frac{2}{3}$  of 24 hundred.  
 30.  $48 \times 16\frac{2}{3}$       33.  $24 \times 62\frac{1}{2}$       36.  $28 \times 75$   
 31.  $32 \times 37\frac{1}{2}$       34.  $36 \times 66\frac{2}{3}$       37.  $40 \times 87\frac{1}{2}$   
 32.  $49 \times 25$       35.  $39 \times 33\frac{1}{3}$       38.  $88 \times 12\frac{1}{2}$   
 39.  $533\frac{1}{3} + 66\frac{2}{3} = 5\frac{1}{3}$  hundred +  $\frac{2}{3}$  hundred = 16 + 2.  
 40.  $337\frac{1}{2} + 37\frac{1}{2}$       42.  $687\frac{1}{2} + 62\frac{1}{2}$       44.  $437\frac{1}{2} + 87\frac{1}{2}$   
 41.  $733\frac{1}{3} + 33\frac{1}{3}$       43.  $933\frac{1}{3} + 66\frac{2}{3}$       45.  $212\frac{1}{2} + 12\frac{1}{2}$

## 288. Oral Problems.

1. How many ounces in  $11\frac{3}{4}$  pounds?
2. 258 yards equal how many feet?
3. A dealer bought 652 tons of coal and sold 476 tons. How much had he left?
4. Sold my wheat for \$347 and my oats for \$154. How much did I receive for both?
5.  $40\frac{2}{3}$  yards of ribbon are cut into 7 pieces. Find the length of each piece.
6. How many square yards in a floor  $5\frac{1}{2}$  yards long and  $5\frac{1}{2}$  yards wide?
7. What will be the cost of 14 pounds of lard at 14¢ per pound?
8. At  $1\frac{1}{2}$ ¢ each, how many lead pencils can I buy for 27¢?

9. What part of a 196-pound barrel of flour is contained in a 49-pound bag?

10. At 45¢ per yard, how much lace can be bought for \$1.35?

11. A woman has saved \$833. How much more must she save to have \$1000?

12. What will be the cost of 16 pounds of sugar at 4½¢ per pound?

13. Spent \$2.56 for dry goods and \$1.84 for groceries. How much did I spend for both?

14. Find the cost of 3 lb. 10 oz. butter at 32¢ per pound.

15. At \$.375 per yard how much ribbon can be bought for \$.75?

16. If it takes 1½ yards of cloth to make a jacket, how many can be made from a piece of cloth containing 30 yards?

17. A boy paid 35¢ for the use of a boat for 3½ hours. What was the price per hour?

18. If 13 pounds of raisins cost \$1.69, what is the cost of 1 pound?

#### APPROXIMATIONS.

289. Give an estimate of the answer:

1. If 3 T. 1988 lb. coal cost \$19.97, what will be the cost of 8 T. 1 lb.?

Nearly 4 tons cost nearly \$20.

2. At \$500 per year, what will be the rent of a house for 1 yr. 11 mo. 29 da.?

Nearly 2 years.

3. Find the cost of 5 barrels sugar, averaging 299 pounds each, at 41½¢ per pound. *200 is a more approximate price*

4. What is the interest on \$199.86 at 6%, for 5 mo. 28 da.?

5. If 11 men and 2 boys can finish a piece of work in  $23\frac{1}{2}$  days, how long will it take 23 men and 5 boys?

*Absolute form of problem*  
6. What decimal of 639 acres is 321 acres?

7. What will be the cost of 20,060 bricks at \$4.90 per M?

8. A farmer sells 5484 pounds rye at 87¢ per bushel of 56 pounds. How much does he receive?

9. If 19 lb. 15 oz. of tea cost \$7.95, what will be the cost of 21 lb. 1 oz.?

10. Paid freight on 1987 pounds at 70¢ per cwt. How much did I pay?

11. If there are about  $7\frac{1}{2}$  gallons to a cubic foot, estimate the number of gallons in a tank 5 feet long, 3 feet wide, 4 feet high.

12. If there are about  $1\frac{1}{4}$  cubic feet in a bushel, estimate the contents in bushels of a bin 5 ft.  $\times$  3 ft.  $\times$  4 ft.

13. Give the dimensions of a tank of 150 gallons' capacity.

14. Give the dimensions of a bin that will hold 100 bushels.

15. At 20 bricks laid in mortar to the cubic foot, give the length and the height of a wall 1 foot thick that can be built with a thousand bricks.

16. At \$1 a load (1 cubic yard), give the dimensions of an excavation that can be made for \$100.

17. A cubic foot of water (about  $7\frac{1}{2}$  gallons), weighs  $62\frac{1}{2}$  pounds. About what does a gallon weigh? A pint?

18. If iron is about  $7\frac{1}{4}$  times as heavy as water, about what does a cubic foot of iron weigh?

19. About what is  $49\frac{1}{2}\%$  of \$801?

20. About what will be the interest at 6 per cent on \$100 for 3 yr. 11 mo. 29 da.?

**FUNDAMENTAL PROCESSES.**

290. 1. The sum of two numbers is 278. One of the numbers is 89. What is the other?

$$89 + ? = 278$$

2. The minuend is 583, the remainder is 249. What is the subtrahend?

$$583 - ? = 249$$

3. The subtrahend is 56, the minuend is 214. Find the remainder.

4. The difference between two numbers is 84, the smaller is 129. What is the larger number?

5. The subtrahend is 176, the remainder is 92. Find the minuend.

6. The multiplier is 98, the multiplicand is 809. Find the product.

7. The product is 9045, the multiplier is 45. What is the multiplicand?

8. The product of two factors is 1767. One of the factors is 93. Find the other factor.

9. The multiplicand is 84, the product is 2100. What is the multiplier?

10. The dividend is 10,000, the divisor is 275. Find the remainder.

11. The quotient is 32, the remainder is 21, the divisor is 40. What is the dividend?

$$\begin{array}{r} 40 \overline{) ?} \\ 32 \overline{) 21} \end{array}$$

12. The dividend is 4263, the quotient is 203. Find the divisor.

$$\frac{4263}{?} = 203$$

13. The dividend is 267, the quotient is 13, the remainder is 7. What is the divisor?

$$\frac{267}{?} = 13 \overline{) 7}$$



**RATIO.****291. Sight Exercises.**

1.  $\frac{87 \times 25}{75}$

3.  $\frac{63 \times 19}{21}$

5.  $\frac{47}{15} \times 75$

7.  $\frac{39}{11} \times 55$

2.  $\frac{74 \times 24}{37}$

4.  $\frac{96 \times 27}{32}$

6.  $\frac{65}{14} \times 42$

8.  $\frac{23}{8} \times 32$

**292. Written Exercises.**

Indicate operations, and cancel where possible. Terms compared should be of the same denomination.

1. If 90 tons of coal cost \$472.50, what will be the cost of 132 tons?

$$\frac{\$472.50 \times 132}{90}$$

2. If 3 lb. 4 oz. tea cost \$1.95, what will 12 oz. cost?

The ratio is 12 oz. to 52 oz.

3. A party of men can build 16 rd. 2 ft. of wall in 20 days. How long will it take them to build 4 yd. 6 in.?

Change to inches.

4. What will be the cost of 3 bu. 2 pk. 7 qt. of oats if 7 bu. 1 qt. cost \$4.50?

5. By travelling at the rate of 20 miles a day, a person can complete a journey in 18 days. At what rate must he travel to finish it in 15 days?

6. How many rolls of merino, each containing 75 yards, worth \$.45 per yard, will it take to pay for 180 yards of alpaca at \$.30 per yard?

7. A merchant sold 20 hogsheads of oil, each containing 63 gallons, at \$1.75 per gallon, and invested the proceeds in table sauce in cases of 12 bottles each, worth \$.31 $\frac{1}{4}$  per bottle. How many cases did he buy?

8. No allowance being made for mortar, how many bricks will be required to build a wall 50 feet long, 4 feet high, and 1 foot 3 inches thick, each brick being 8 inches long, 4 inches wide, and  $2\frac{1}{2}$  inches thick?

9. If .1875 of a vessel cost \$273.12 $\frac{1}{2}$ , what is the value of  $\frac{5}{8}$  of it at the same rate?

10. What is the cost of 60.51 tons of coal, when .9 of a ton costs \$6.66?

### REVIEW OF FRACTIONS.

#### 293. Add across:

If the pupils work from their books the following examples in addition and subtraction, they should be permitted to write only the answers. The teacher should announce the number of an example, not taking them in order, then the number of the next to be worked, without giving time for the writing of unnecessary figures.

1.  $13\frac{1}{2} + 16\frac{2}{3} + 8\frac{3}{4}$

6.  $59\frac{5}{7} + 3\frac{1}{2} + 4\frac{3}{4}$

2.  $4\frac{1}{4} + 5\frac{2}{5} + 27\frac{3}{8}$

7.  $7\frac{5}{8} + 18\frac{2}{3} + 40\frac{1}{6}$

3.  $19\frac{1}{8} + 3\frac{5}{8} + 35\frac{1}{2}$

8.  $35\frac{2}{3} + 51\frac{1}{2} + 8\frac{7}{10}$

4.  $8\frac{1}{2} + 9\frac{3}{10} + 14\frac{1}{4}$

9.  $3\frac{7}{8} + 9\frac{1}{8} + 25\frac{7}{7}$

5.  $23\frac{3}{8} + 5\frac{1}{4} + 32\frac{5}{12}$

10.  $66\frac{1}{2} + 8\frac{2}{3} + 14\frac{1}{2}$

#### 294. Subtract across:

11.  $25\frac{1}{4} - 18\frac{7}{12}$

16.  $68\frac{3}{4} - 61\frac{1}{2}$

12.  $63\frac{2}{3} - 49\frac{2}{3}$

17.  $100\frac{1}{3} - 62\frac{1}{4}$

13.  $70\frac{4}{11} - 15\frac{1}{2}$

18.  $56\frac{1}{4} - 37\frac{3}{8}$

14.  $92\frac{5}{8} - 24\frac{7}{8}$

19.  $83\frac{3}{4} - 43\frac{3}{8}$

15.  $33\frac{1}{4} - 15\frac{7}{10}$

20.  $42\frac{1}{2} - 16\frac{3}{4}$

**295. Multiply:**

When the fractions are small and the fraction in the multiplicand has 1 for its numerator, business men do not change the mixed numbers to improper fractions.

In multiplying  $38\frac{1}{2}$  by 11, the product of  $\frac{1}{2}$  by 11 is mentally reduced to  $8\frac{1}{2}$ , and  $\frac{1}{2}$  written; 11 eights (88), and 8 (96), 6 being written; etc.  $\frac{1}{2}$  of  $38\frac{1}{2}$  is 4 (written) with  $6\frac{1}{2}$  remainder. This is reduced to  $2\frac{1}{2}$  mentally, and its  $\frac{1}{2}$ , or  $\frac{1}{4}$ , written.

$$\begin{array}{r} 37\frac{1}{2} \times 3\frac{1}{2} \\ 112\frac{1}{2} \\ 18\frac{3}{4} \\ \hline 131\frac{1}{4} \text{ Ans.} \end{array}$$

$$\begin{array}{r} 12\frac{3}{4} \times 5\frac{1}{8} \\ 63\frac{3}{4} \\ 4\frac{1}{4} \\ \hline 68 \text{ Ans.} \end{array}$$

$$\begin{array}{r} 38\frac{1}{2} \times 11\frac{1}{2} \\ 426\frac{1}{2} \\ 4\frac{3}{4} \\ \hline 431\frac{3}{4} \text{ Ans.} \end{array}$$

21.  $48\frac{1}{2} \times 4\frac{1}{2}$

24.  $18\frac{7}{8} \times 5\frac{1}{2}$

27.  $45\frac{1}{2} \times 2\frac{1}{2}$

22.  $64\frac{1}{2} \div 10\frac{1}{2}$

25.  $13\frac{1}{2} \times 7\frac{1}{2}$

28.  $50\frac{1}{2} \times 10\frac{1}{2}$

23.  $29\frac{3}{8} \times 6\frac{1}{2}$

26.  $9\frac{3}{4} \times 8\frac{1}{2}$

**296. Divide:**

29.  $13 \overline{)205\frac{1}{2}}$

The pupil should endeavor to work the following by short division :  
13 into 20, once ; into 75, 5 times, remainder  $10\frac{1}{2}$  or  $\frac{21}{2}$  ;  $\frac{1}{13}$  of  $\frac{21}{2} = \frac{21}{26}$ .  
*Ans.  $15\frac{21}{26}$ .*

30.  $14 \overline{)186\frac{1}{2}}$

37.  $21 \overline{)450\frac{1}{2}}$

44.  $25 \overline{)568\frac{1}{2}}$

31.  $15 \overline{)250\frac{1}{2}}$

38.  $31 \overline{)970\frac{1}{2}}$

45.  $32 \overline{)965\frac{1}{2}}$

32.  $16 \overline{)198\frac{1}{2}}$

39.  $24 \overline{)553\frac{1}{2}}$

46.  $36 \overline{)722\frac{1}{2}}$

33.  $17 \overline{)190\frac{1}{2}}$

40.  $23 \overline{)466\frac{1}{2}}$

47.  $16 \overline{)366\frac{1}{2}}$

34.  $18 \overline{)200\frac{1}{2}}$

41.  $26 \overline{)290\frac{1}{2}}$

48.  $17 \overline{)208\frac{1}{2}}$

35.  $19 \overline{)381\frac{1}{2}}$

42.  $27 \overline{)545\frac{1}{2}}$

49.  $21 \overline{)640\frac{1}{2}}$

36.  $22 \overline{)264\frac{1}{2}}$

43.  $33 \overline{)999\frac{1}{2}}$

50.  $22 \overline{)888\frac{1}{2}}$

## REVIEW OF DECIMALS.

## 297. Sight Exercises.

Give products:

- |                      |                                 |                                  |
|----------------------|---------------------------------|----------------------------------|
| 1. $360 \times .25$  | 8. $840 \times .075$            | 15. $400 \times .04$             |
| 2. $560 \times .125$ | 9. $960 \times .005$            | 16. $165 \times .06\frac{1}{2}$  |
| 3. $240 \times .375$ | 10. $1200 \times .001$          | 17. $176 \times .06\frac{1}{4}$  |
| 4. $400 \times .625$ | 11. $1500 \times .002$          | 18. $3300 \times .00\frac{1}{2}$ |
| 5. $480 \times .75$  | 12. $96 \times .3\frac{1}{2}$   | 19. $880 \times .12\frac{1}{2}$  |
| 6. $320 \times .875$ | 13. $840 \times .02\frac{1}{2}$ | 20. $105 \times .8$              |
| 7. $720 \times .025$ | 14. $1500 \times .06$           | 21. $210 \times .10$             |

## 298. Give quotients:

- |                    |                              |                              |
|--------------------|------------------------------|------------------------------|
| 1. $240 \div .5$   | 8. $37 \div .05$             | 15. $76 \div .04$            |
| 2. $360 \div .75$  | 9. $48 \div .005$            | 16. $88 \div .00\frac{1}{2}$ |
| 3. $45 \div .125$  | 10. $72 \div .025$           | 17. $65 \div .12\frac{1}{2}$ |
| 4. $23 \div .25$   | 11. $92 \div .002$           | 18. $84 \div .8$             |
| 5. $360 \div .375$ | 12. $93 \div .03\frac{1}{2}$ | 19. $11 \div .06\frac{1}{4}$ |
| 6. $100 \div .625$ | 13. $54 \div .02\frac{1}{2}$ | 20. $42 \div .6\frac{1}{2}$  |
| 7. $154 \div .875$ | 14. $132 \div .06$           | 21. $93 \div .5$             |

## 299. Written Exercises.

- Find the value of  $(6.125 + 8.75 - 9.1235) \div .0125$ .
- Find the value of  $(1708.4592 \div .00024) \times .003$ .
- Simplify  $\frac{7 - 3.004}{.2 + 7.3} \times \frac{5 - .08}{4.8} \div 1\frac{1}{2}$ .
- Multiply 24.234 by .346, and write the result in words.
- Divide 96 ten-thousandths by 384 hundred-millionths.

6. Why does the value of a decimal remain unchanged when ciphers are annexed ?

7. Write : four hundred seven thousandths.

8. Write : six hundred four millionths.

9. Write in words 405.0067542.

10. Reduce to common fractions in lowest terms :

.004 ; .0125 ;  $56.37\frac{1}{2}$ .

11.  $16\frac{1}{2} \times .045 = ?$   $.324 \times .33\frac{1}{2} = ?$   $3.406 \times 1.00 = ?$

12.  $.805 \div .35 = ?$   $80.5 \div 350 = ?$  Divide twenty-five thousandths by 16 millionths.

13. Write in words :

.0105 ; 000125 ; 1.001105 ; 11.4141 ; .000008.

14. Reduce to common fractions : .95 ; .526.

15. From one thousand and (decimal) five thousandths take eight hundred and (decimal) eight hundredths.

16. Divide eight hundredths by four thousandths, and multiply the quotient by six ten-thousandths.

17. Find the product of the following factors : .064, .0032, 15,625, and 31.25.

### 300. Oral Review Problems.

1. At 20¢ per quart, what will be the cost of 2 gal. 3 qt. 1 pt. of maple syrup ?

2. Find the cost of 4 T. 400 lb. of coal at \$5 per ton.

3. A man puts 4 lb. 8 oz. of tea into 9-ounce packages. How many packages does he make ?

4. 4 pk. 3 qt. of apples are given to some children. If each child's share is 5 quarts, how many children are there ?

5. If it takes 3 hr. 20 min. to hoe a row of corn, how many rows can a man do in 2 days of 10 hours each ?

6. How many dozen eggs at 25¢ a dozen must be given for 100 pounds of sugar at 5¢ a pound?

7. Which would you rather have,  $\frac{7}{8}$  of a dollar or 75¢? Why?

8. What will a gallon of molasses cost if a gill costs 2 $\frac{1}{2}$ ¢?  
1 gill =  $\frac{1}{4}$  pint

9. Give the names to the results in the four simplest processes in arithmetic.

10. \$15 per week is how much per day?

11.  $\frac{5}{8}$  of 72 is  $\frac{3}{4}$  of what number?

12. How many cubic feet in  $\frac{3}{8}$  of a cubic yard?

13. Which is the larger and how much larger,  $\frac{4}{5}$  of 130 or  $\frac{3}{4}$  of 119?

14. Which is the larger and how much,  $\frac{5}{7}$  or  $\frac{3}{4}$ ?

15. How many cubic feet in a wall 30 feet long, 4 feet high, and 2 feet thick?

16. If  $\frac{3}{8}$  of a barrel of flour cost \$2.13, what cost 1 $\frac{1}{2}$  barrels?

17. The difference between 144 and 24 is how many times 15?

18. John walked 12 $\frac{3}{4}$  miles, and Henry 10 $\frac{5}{8}$  miles. How much farther did John walk than Henry?

19. At 4 $\frac{1}{2}$ ¢ a pint, what will 5 qt. 1 pt. of milk cost?

20. After spending  $\frac{3}{8}$  of his money, James has \$150 left. What amount did he have at first?

21. How many gallons in 462 cubic inches?

22. If a boy eats  $\frac{3}{8}$  of a loaf of bread, how many boys will be required to eat 10 loaves?

23. 5 yd. cloth cost 90¢; find the cost of  $\frac{3}{4}$  yd.

24. If  $\frac{3}{4}$  yd. of cloth costs 10¢, how many yards can be bought for 80¢?

25. A step is 3 feet. 2 steps are what part of a rod?
26.  $19 + 3 + 17 + 6 + 15 + 4 = ?$
27. John had 85¢. He bought strawberries for 22¢; 1 pound coffee for 30¢; 3 sheets paper at 1¢ a sheet. What remained?
28. Three-fourths of a mince pie is worth 18¢, and James eats  $\frac{1}{4}$  of a pie. What is the value of what he eats?
29. If I have 1 pk. 2 qt. 1 pt. of meal, how many more quarts must there be to make 1 bushel?
30. Charles caught 12 fish, worth  $4\frac{1}{2}$ ¢ each, in four hours. His time was worth 12¢ an hour. Gain or loss, and how much?
31. How many times would a dish holding  $\frac{3}{4}$  of a pint have to be filled to measure 9 quarts?
32. If 5 chairs cost \$80, what will 12 chairs cost?
33. How many hours from 4 A.M. to 8 P.M.?
34. Reduce  $\frac{3}{4}$  to lowest terms.
35. Add  $\frac{1}{2}$  to  $\frac{3}{4}$ , and take the sum from 5.
301. Written Review Problems.
1. What part of 6 hr. 54 min. are 3 hr. 15 min.?
  2. If a man walks at the rate of 3 mi. 96 rd. per hour, how far will he walk in 3 hr. 20 min.?
  3. What is one-ninth of 28 bu. 3 pk. 7 qt.?
  4. Three men buy a house for \$1200. A furnishes \$600; B, \$400; C, \$200. They sell the house for \$1500. How much money should each receive?
  5. If 5 T. 1000 lb. of coal cost \$30.25, how much will be paid for 7 T. 320 lb.?
  6. At 25¢ per hour, how much should a man receive that works 8 hours and 36 minutes?

7. If 2 lb. 4 oz. of tea cost \$1.35, what will be the cost of 11 lb. 12 oz.?

8. How many square inches in a paving tile 6 inches square? How many square inches in a rectangle 4 feet by 3 feet? How many paving tiles 6 inches by 6 inches would cover a surface 4 feet by 3 feet?

9. A man buys a house and lot for \$3000. He pays  $\frac{2}{3}$  of the amount in cash and the remainder after 1 year, 4 months, with 5% interest. Find the amount of the second payment.

10. Find four-ninths of 28 bu. 3 pk. 7 qt.

11.  $(\frac{2}{3} \text{ of } \frac{7}{8}) + (\frac{2}{3} \text{ of } \frac{4}{9}) - (\frac{4}{9} \text{ of } 2) = ?$

12.  $\frac{\frac{1}{2} \text{ of } 7\frac{1}{2}}{\frac{2}{3} \text{ of } 15} - \frac{\frac{2}{5} \text{ of } 4\frac{3}{4}}{1\frac{1}{2} \times 11} = ?$

13. Add  $8\frac{5}{7} + \frac{3}{4} + \frac{5}{8} + \frac{3}{11} + \frac{2}{3}$ .

14. Find the value of  $728 - \frac{3}{4} - \frac{1}{7} - \frac{2}{5} - \frac{1}{8}$ .

15.  $1\frac{1}{2} \times (\frac{3}{4} + \frac{2}{3}) \times \frac{1}{8}$ .

16. Reduce  $\frac{7}{10}$  of  $\frac{2}{3}$  of  $\frac{3}{4}$  of  $\frac{13.5}{7}$  to a decimal.

17. A person owning  $\frac{2}{10}$  of a factory sells 75 per cent of his share for \$1710. What is the value of the whole factory?

18. Find  $\frac{3}{4}$  of 2 da. 5 hr. 40 min.

19. If a piece of cloth is 20 yards long and  $\frac{3}{4}$  yard broad, how broad is another piece which is 12 yards long and contains as many square yards as the first?

20. Simplify  $\frac{2\frac{1}{2} + 1\frac{1}{2}}{2\frac{1}{2} - 1\frac{1}{2}} \times \frac{1\frac{7}{8} - 1}{\frac{1}{4} + \frac{3}{8}}$ .

21. If 7 men can do a piece of work in  $10\frac{1}{2}$  days, how long will it take 8 men and 5 boys to do the same work, each boy doing one-half as much as a man?



22. A farmer drew to market three loads of wheat, weighing respectively 2873 pounds, 3027 pounds, and 2911 pounds. At 93¢ per bushel (60 pounds), how much did he receive for the three loads?

23. How many acres of land are there in a rectangular farm  $\frac{1}{2}$  of a mile long and  $\frac{3}{4}$  of a mile wide? (1 square mile = 640 acres.)

24. Reduce  $\frac{2\frac{1}{2} \div 4\frac{2}{3}}{8\frac{1}{2} - 3\frac{1}{3}}$  to a simple fraction.

25. The sum of two numbers is  $15\frac{3}{8}$ , and one of them is  $9\frac{1}{16}$ . Find the other number.

26. If 3 be added to both terms of the fraction  $\frac{5}{8}$ , will the value be increased or diminished, and how much?

27. Make and solve a problem to illustrate reduction descending; one to illustrate reduction ascending.

28. How is the value of a fraction changed by increasing its denominator? Why?

29. Add  $\frac{3}{4}$  hours,  $20\frac{3}{4}$  minutes, and 49.2 seconds. Express the answer in minutes and seconds.

30. What fractional part of  $31\frac{3}{8}$  is  $12\frac{1}{4}$ ?

31. In a hotel the weekly wages of the clerk are \$15, of the cook \$7.50, of the porter \$9, of the waiter \$3, of the hostler \$6, and of the errand boy \$4. Find the average wages paid.

32. A man was born May 24, 1832. What is his age to-day?

33. A grocer's bill for \$84.36 is paid 8 months 15 days after it becomes due, with interest at 5%. How much is paid?

34. Find the cost of 7 lb. 11 oz. of cheese at 13¢ per pound.

35. Find the cost of digging a cellar 30 feet long, 15 feet wide, and 5 feet deep, at 30¢ per cubic yard.

36. John Smith bought of Clark and Jones,

4 lb. 13 oz. beefsteak @ 21¢ per lb.

12 lb. of bacon @ 12½¢.

Make a properly receipted bill of the above, dated at the time and place of this lesson.

37. Find the cost of 2315 pounds of coal at \$5.75 per ton.

38. Write 1249 in Roman notation.

39. Given the dividend 807 and the quotient  $34\frac{1}{3}$ , find the divisor.

40. What will it cost to fill a jug, which contains 2310 cubic inches, with vinegar at 7 cents a quart?

(1 gal = 231 cu. in.)

41. Mrs. C. B. Jones bought of Cole, Steele, & Co., of Indianapolis, as follows: Nov. 12, 1904, 23 yards of muslin @ 16½¢; 45 yards of sheeting @ 12½¢; Dec. 7, 12 yards of silk @ \$1.62½; 8 handkerchiefs @ 45¢; 2 pairs kid gloves @ \$1.37½; 6 neckties @ 75¢. Make out and receipt the above bill.

42. If a boy bought  $\frac{3}{8}$  of a bushel of nuts for \$2.00, and sold them for 12¢ a quart, what was his gain?

*absolute* 43. Reduce  $\frac{5}{12}$  of an inch to the fraction of a rod.

~~44.~~ Reduce 35 quarts to the fraction of a barrel ( $31\frac{1}{2}$  gal.).

~~45.~~ 3450 cubic feet to cubic yards.

45. Put the following in the proper form of a bill, find the amount of the bill, and receipt it:

David Wilson bought of Harry Lloyd, June 10, 1904, 7 pounds of oatmeal at 6¢ a pound; 10 pounds of sugar at 7½¢ a pound; 14 pounds of ham at 13½¢ a pound; 3 brooms at \$2.25 a dozen.

67. A man has 768 hens, which is  $\frac{1}{4}$  more than he had last year. How many had he then?

68. Two trains are  $87\frac{1}{2}$  miles apart and running toward each other, one at the rate of  $50\frac{3}{4}$  miles an hour, and the other at the rate of  $20\frac{1}{2}$  miles an hour. How far apart will they be in half an hour?

69. If 35 men earn \$87.50 in 1 day, how much will 50 men earn in 10 days?

70. Multiply 9008 by 7080, and divide the product by 600.

71. What is the difference between  $69 \times 58.8$  and  $291 + 0.97$ ?

72. Find  $6\frac{1}{4}\%$  of 19,712 miles.

$62\frac{1}{2}\%$  of 2768 yards.

$9\frac{1}{11}\%$  of 11,223,344 pounds.

73. What is the interest of \$150 for 2 yr. 8 mo. 15 da., at 6% per annum.

74. Add: 25,037.45; 8,712.23; 9050.37; 815.25; 91,017.16; 419.19; 2035.75; 15,025.55; 7079.13; 14026.27.

75. Add: 87.27; 43.75; 72.50; 39.75; 64.04; 58.94; 95.83; 26.37; 75.96; 50.83; 39.49; 97.08; 62.62.

76. A lot of land containing 5250 square feet is 125 feet long. What is the perimeter?

77. A man spent  $\frac{2}{5}$  of his money for a house,  $\frac{1}{6}$  for furniture,  $\frac{1}{8}$  for horses, and  $\frac{3}{8}$  to build a church. What part of his money had he left?

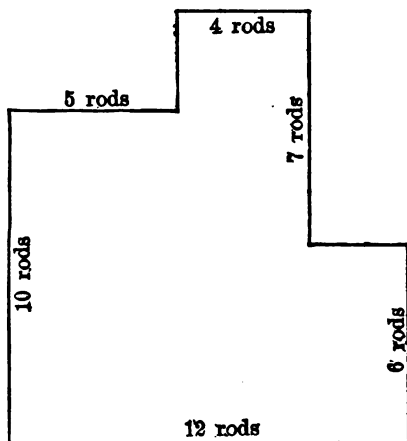
78. Bought 10,752 cubic feet of wood at \$8 $\frac{1}{2}$  a cord. What did it all cost?

79. Change  $\frac{\frac{2}{3} \text{ of } \frac{4}{5}}{15}$  to a simple fraction.

80.  $9\frac{1}{2}$  times  $\frac{1}{2}$  of  $56\frac{1}{2}$  is how much?

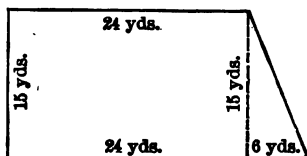
81. What is the cost of digging a cellar 27 feet square and 9 feet deep at 25¢ a cubic yard.

82. How many yards of fence will be needed to enclose the plot of ground shown in the following diagram?



83. The above field was originally a rectangle, but the owner sold one piece 5 rods by 3 rods, and a second piece 3 rods by 7 rods. How many square rods did it contain at first? What is its present area?

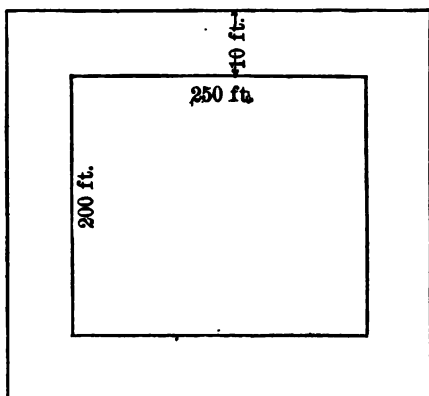
84. Calculate the number of square yards in the field shown in the accompanying diagram.



85. A man buys a piece of ground 300 feet long, 150 feet wide. He builds a house, 50 feet by 30 feet, and a shed 12 feet by 13 feet. How many square feet will he have left for a garden?

86. The owner of a piece of ground 250 feet long, 200 feet wide, takes 10 feet from each side to make a gravel walk, and uses the remainder for a garden. Give the dimensions of the garden and its area in square feet? How many square feet in the whole piece of ground? How many square feet are taken up by the walk?

87. How many square feet of flagging would be required for a sidewalk 10 feet wide outside a lot 250 feet long, 200 feet wide?



88. If a piece of carpet is 27 inches wide, and contains 48 square yards, how long is it?

89. I have bought 24 yards of dress goods, 27 inches wide. How many square yards does the piece contain?

How many yards of lining 32 inches wide will contain the same number of square yards?

24 yards long.		? yards long.	
$\frac{1}{4}$ yd. <span style="border: 1px solid black; padding: 5px 20px;">18 sq. yd.</span>	=	<span style="border: 1px solid black; padding: 5px 20px;">18 sq. yd.</span>	$\frac{1}{4}$ yd.



A



# Where is Table of U.S. Money?

## TABLES

### LINEAR MEASURE

12 inches (in.)	= 1 foot.	ft.
3 feet	= 1 yard	yd.
5½ yards, or 16½ feet	= 1 rod	rd.
40 rods	= 1 furlong	fur.
320 rods	= 1 mile	mi.

$$1 \text{ mi.} = 320 \text{ rd.} = 1760 \text{ yd.} = 5280 \text{ ft.} = 63,360 \text{ in.}$$

A *hand*, used in measuring the height of horses, = 4 in. A *knot*, used in measuring distances at sea, = 1.15 mi. A *fathom*, used in measuring the depth of the sea, = 6 ft.

### SQUARE MEASURE

144 square inches (sq. in.)	= 1 square foot	sq. ft.
9 square feet	= 1 square yard	sq. yd.
30½ sq. yd., or 272½ sq. ft.	= 1 square rod	sq. rd.
160 square rods	= 1 acre	A.
640 acres	= 1 square mile	sq. mi.

$$1 \text{ A.} = 160 \text{ sq. rd.} = 4840 \text{ sq. yd.} = 43,560 \text{ sq. ft.}$$

A *Section* of land is a square mile.

Roofing, flooring, and slating are often estimated by the *square*, which contains 100 square feet.

### SURVEYORS' MEASURE

In measuring land, surveyors use a chain (ch.) which contains 100 links (l.) and is 4 rods long. Since the chain is 4 rods long, a square chain contains 16 sq. rd., and 10 sq. ch. = 160 sq. rd., or 1 acre.

### CUBIC MEASURE

1728 cubic inches (cu. in.)	= 1 cubic foot	cu. ft.
27 cubic feet	= 1 cubic yard	cu. yd.
128 cubic feet	= 1 cord	cd.
16 cubic feet	= 1 cord ft.	cd. ft.
8 cord feet	= 1 cord	cd.

**NOTE.**—In computing the contents of an enclosing wall, masons and brick-layers regard it as one straight wall whose length is the distance around it on the outside. Corners are thus measured twice.

A *perch* of stone or masonry is 16½ ft. long, 1½ ft. thick, and 1 ft. high, and contains 24½ cu. ft.

## MEASURES OF CAPACITY

### LIQUID MEASURE

4 gills = 1 pint . . . pt.  
2 pints = 1 quart . . . qt.  
4 quarts = 1 gallon . . . gal.

### DRY MEASURE

2 pints = 1 quart . . . qt.  
8 quarts = 1 peck . . . pk.  
4 pecks = 1 bushel . . . bu.

The *standard gallon* contains 231 cubic inches.

The *standard bushel* contains 2150.42 cubic inches.

The capacity of cisterns, reservoirs, etc., is often expressed in barrels (bbl.) of 31½ gallons each, or in hogsheads (hhd.) of 63 gallons each. In commerce, these vary in size.

## AVOIRDUPOIS WEIGHT

16 ounces (oz.) . . . = 1 pound . . . lb.  
100 pounds . . . = 1 hundredweight . . . cwt.  
2000 pounds . . . = 1 ton . . . T.

One pound Avoirdupois = 7000 grains.

The *long ton* of 2240 pounds is used in the United States Custom Houses and in weighing coal and iron at the mines.

## STANDARD WEIGHTS

1 bushel of wheat . . . = 60 lb.    1 bushel of potatoes . . . = 60 lb.  
1 bushel of corn . . . = 56 lb.    1 barrel of flour . . . = 196 lb.  
1 bushel of oats . . . = 32 lb.    1 barrel of pork . . . = 200 lb.  
1 bushel of barley . . . = 48 lb.    1 keg of nails . . . = 100 lb.

## TROY WEIGHT

24 grains (gr.) . . . = 1 pennyweight . . . pwt.  
20 pennyweights . . . = 1 ounce . . . oz.  
12 ounces . . . = 1 pound . . . lb.

One pound Troy = 5760 grains.

## APOTHECARIES' WEIGHT

60 grains (gr.) . . . = 1 dram . . . dr., or ʒ.  
8 drams . . . = 1 ounce . . . oz., or ʒ.  
12 ounces . . . = 1 pound . . . lb., or lb.

One pound Apothecaries' weight = 5760 grains.

## BRITISH OR STERLING MONEY ✓

4 farthings . . . = 1 penny . . . d.  
12 pence . . . = 1 shilling . . . s.  
20 shillings . . . = 1 pound . . . £.  
5 shillings . . . = 1 crown.

The value of £1 is 20 shillings in United States gold coin.

The unit of French money is 1 franc. The unit of German money is 1 mark, w

